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SCIENCE

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A NEW PHASE OF UNIVERSITY EXTENSION.

JUST at the present critical stage of the American movement for extension teaching the practical pedagogy of this imported phase of educational activity is up for sharp and earnest discussion. It is agreed that however properly the system may have been been reared in England, American methods must be applied to its life if it is to become a recognized force in American education. The naturalization of University Extension must therefore pre-eminently mean its further organization toward useful ends.

The recent article of Professor Willis Boughton on "Graded Work in Philadelphia," strikes the key-note for an earnest and scientific discussion, which we hope may be continued until the American society shall have nurtured extension teaching into one of the most vital forms of educational activity. Professor Boughton has outlined the plan for graded work to be pursued at certain centres, and has, moreover, called attention to the division of the Philadelphia work into "departments," although a thorough organization of these "departments" has not as yet been distinctly mooted. It is also here pertinent to note that the president of the American society, Dr. Edmund J. James, has in Philadelphia introduced the excellent plan of faculty meetings of the lecturers, with the view of eliciting the practical pedagogics of the subject.

As an attempt to continue a discussion looking toward efficient organization of university extension, the writer presents for candid criticism the following somewhat comprehensive suggestions. Stated with almost dogmatic brevity, the scheme is submitted, none the less, in the scientific spirit, and expects no other mark of favor than that derived from its accordance with the experienced facts.

The scheme proposes to establish in each great university centre extension faculties and sub-faculties of the various departments of knowledge for the development of real class-work and individual study, alongside the present lecture system. Each faculty shall in itself form a complete organization, with officers of good executive talent and broad sympathies. The presidents of the faculties, together with the president of the centre, shall form a body advisory to the executive committee of the centre.

It shall be the duty of each president, in concert with his faculty, to develop the best methods of exciting popular interest in the special subjects, and especially to determine upon the pedagogic methods best adapted to the particular subjects and to the various grades of students seeking the extension classes.

Each faculty shall, as far as practicable, arrange for class instruction continuing during eight or nine months of the year, or at any rate for courses of sufficient length to meet some tangible purpose.

Each faculty, and finally each professor, shall aim to carry along the individual in his work, rather than aim to present finely-wrought lectures — the latter being used as accessory only to the main purpose.

Inasmuch as such proposed instruction would of necessity be more expensive and demand a closer relation between the professor and the student than the present methods of extension organization seem to encourage, it would seem desirable that these special extension classes be sharply distinguished from the general extension classes. The latter are and should be open to all members, but the former only to such members as meet the terms for the special tuition, and are willing to engage in regular student work.

It would also seem proper that the tuition for each special class course should, to some extent, depend upon the number of students applying, as well as upon the nature of the subject developed.

The eventual outcome of such scheme of instruction would doubtless be the award of highly-prized certificates of the work done, or what comes to the same, the conferring of degrees, either through the universities or through the extension society itself.

As an application of this scheme of organization to a particular department, let us suppose the mathematical professors, say of the Philadelphia extension course, to be organized as a unit faculty. The courses they should propose would range from algebra, through a goodly variety of applied mathematics, to general, or even practical astronomy. Each course would be carried on in some relation to the other courses. The most cordial co-operation would exist between the several classes and professors, and both students and professors work in one or the other class, as the furtherance of the most efficient work and teaching might demand.

As an example of the method suggested, when carried down to an actual class course, the writer may be permitted to instance a course in the theory and practice of surveying, intended as one element of a school of mathematics recently proposed by him to the Philadelphia Society for University Extension. The course is based on a demand for such instruction coming to him from two classes of students, viz., (1) practical surveyors ill equipped in the mathematics of the subject, and (2) young men, who, although busily engaged during the day in other employments, desire, if possible, to equip themselves for the life of a surveyor or civil engineer. The instruction is to be given in class, by correspondence, and in the field. The class instruction, given one evening each week for eight months, embraces text-book work pursued under direction, and as rapidly as each student is able lectures on instruments, their construction, adjustment, and use, and on methods of field and office work. Correspondence is encouraged for the purpose of eliciting a better knowledge of each man's difficulties. Replies are to be given through the medium of a specially-trained stenographer or in class. Field instruction is necessarily limited to occasional work of Saturday afternoons. Practically every student is also his own class, pursuing his own work, and receiving help according to his individual needs. The method of learning by doing — ever a good one provided it is doing by method — meets also, as thus guided, the requirements of the ungraded mass of students seeking the special knowledge.

The writer would violate the very spirit of his suggestion were he to attempt to show in detail how it might apply to well-organized evening schools of chemistry, or biology, or history. But he ventures to suggest the pedagogic purposes must in these subjects differ *inter se* and from those of mathematics, and that here the chemical laboratory, the museum of natural history, and the seminar method might find interesting and useful extension.

A fair appreciation of the occasion for the above suggestions requires a concise statement of some of the assumptions made in reference to the aims and ends of university extension. It has been assumed that the final aim is to bring as much of each subject attempted, to each individual student, as the nature of the subject, the time, and the capacity of the individual student may warrant.

It has been assumed that the extension society, as the popular representative of the university, is jealously alive to the danger of indirectly promulgating false conceptions concerning the higher education, of placing mental intoxication on the same plane with mental work, or of discrediting university training, either by unsuitable methods of popular instruction, or by appearing to give all of the university training in twelve easy evening lessons.

It has been assumed that there is a popular demand, active or latent, for highly specialized information fully up to date, and

such as it is alone the province of the specialist of the university to collect and promulgate.

Finally it has been assumed that as nothing save advantage can come to those seeking the special knowledge, whether for use or culture, so nothing save advantage can accrue to the university extension system or to the university itself from the adoption of a scheme of evening instruction fairly suited to the needs of the individual student. M. B. Snyder.

NOTES AND NEWS.

It will interest cremationists to hear that the Japanese, who some time ago adopted burial of the dead, in imitation of European nations, have reverted, according to the *Indian Medical Gazette*, to their own custom of burning the dead on account of its sanitary recommendations.

— The death of Dr. F. C. Dietrich, keeper of the Botanical Museum at Berlin, is announced. He was eighty-six years of age.

— A despatch to the New York *Tribune*, from Franklin, Ind., Dec. 26, states that Professor Gorby, State Geologist, has given his collection to Franklin College. The collection consists of 40,000 to 60 000 specimens, gathered from almost every State in the Union, and from many foreign countries.

— At the Dec. 10 meeting of the Royal Society, according to *Nature*, the president read from the chair a letter from Professor Dewar, which had been put into his hand as he entered the meeting-room, in which Professor Dewar stated that he had at 3 P.M. that afternoon "placed a quantity of liquid oxygen in the state of rapid ebullition in air (and therefore at a temperature of — 181° C.) between the poles of the historic Faraday magnet in a cup-shaped piece of rock salt (which is not moistened by liquid oxygen and therefore keeps it in the spheroidal state)," and to his surprise, Professor Dewar saw the liquid oxygen, as soon as the magnet was stimulated, "suddenly leap up to the poles and remain there permanently attracted until it evaporated."

— The educated classes of Italy are delighted with the proposed changes at the ancient University of Bologna. The commission appointed by the Government to consider the advisability of making reforms in the old institution has recommended the adoption of the plans of Signor Buriani, the well-known engineer. The cost of the new buildings, which will be an ornament to the city, is estimated at 5,000,000 lire. The philosophical and legal faculties will be housed in future in the old "Archiginnasio," while the School of Mines will occupy the present university building on the Via Zamboni. The library united with the royal and city libraries will be placed in a new palace. Great improvements will be made also in the School of Medicine, which in recent years has suffered somewhat in reputation. The University of Bologna has as grand traditions as any university in the world, and college men in all countries feel an interest in its welfare. It is, in many ways, the mother of universities, and had centuries ago 12,000 students.

— Dr. Langer, says *The Medical Record*, has been investigating the subject of suicide among the soldiers in European armies, his statistics including the years from 1875 to 1887. The largest number of suicides occurred in the Austrian army, averaging 123 a year in each 10,000 soldiers. Next to Austria is Germany, which averaged 63 suicides to every 10,000 soldiers. In the Italian army on the average 40 soldiers in every 10,000 committed suicide every year. The French army from 1872 to 1889 lost in Europe 29 soldiers to every 10,000 annually, and in Algeria it lost just twice as many by suicide. In Belgium there occurred 21, in England 23, in Russia 20, and in Spain 14 to every 10,000. The cause of suicide in the army appears in most cases to be the fear of punishment, though not a few are driven to the act through aversion to military service and despair of ever being able to return to civil life.

— In a paper, read before the Sanitary Convention at Vicksburg, the proceedings of which are published, Dr. Baker of the Michigan State Board of Health gave official statistics and evidence which he summarized as follows: "The record of the great saving of human life and health in Michigan in recent years is one to which, it seems to me, the State and local boards of health in Michigan can justly 'point with pride.' It is a record of the saving of over one hundred lives per year from small-pox, four hundred lives per year saved from death by scarlet fever, and nearly six hundred lives per year saved from death by diphtheria — an aggregate of eleven hundred lives per year, or three lives per day saved from these three diseases. This is a record which we ask to have examined, and which we are willing to have compared with that of the man who 'made two blades of grass grow where only one grew before.'"

— A recent press dispatch states that Superintendent Johnson of the Deaf and Dumb Institute at Indianapolis has been making experiments with the phonograph, and believes that in connection with it he can teach the majority of the deaf-mutes under his charge to talk. He finds that the instrument concentrates the sound at the drum of the ear in such a way that many of the pupils otherwise deaf are enabled to hear. He intends to carry the experiments further, and thinks the phonograph may become a means of teaching the use of their voices to some mutes whose inability to speak is due to the fact that they have never heard speech. He tried the phonograph with 27 boys and 29 girls. Of these, only 8 girls were unable to hear something. Twenty boys and girls could hear instrumental music, while 11 boys and 15 girls could distinguish spoken words. Of the 56 whose hearing was tested, 28 could hear better with the left ear and 14 with the right, while 11 heard alike in both.

— It is much to be feared that, after all the stir which has been made about it, the Antarctic expedition which was to have been sent out next year, at the joint expense of the Australian colonies and Baron Oscar Dickson of Gothenburg, may have to be dropped owing to the supineness of the Australians. In July last it was announced that the Queensland Government was to place £3,000 in the colonial estimates as a contribution to the expedition. Sir Henry Parkes undertook to get £2,000 from New South Wales, while from Victoria a sum was expected commensurate with the importance of that colony. Sir Thomas Elder also promised £5,000 on certain conditions, while Baron Oscar Dickson undertook to give another £5,000, and, indeed, was quite prepared to spend double that amount to insure that the expedition should be a success. What with cash and promises, the sum of £14 000 seemed secure in July last, and it was confidently expected that £2,000 should be raised, so as to be well over the £15,000 which it was calculated the expedition would cost. Baron Nordenskjold was quite prepared to take charge of the expedition; and, as stated in the London *Times*, Baron Dickson had actually selected the two ships which he thought suitable for the work. Now we learn that the Queensland Parliament has refused to pass the vote of £2,000 which was placed upon the estimates. It is not only the direct loss of this subscription which is to be deplored, but it affects the other promises, which were made conditionally. Baron Dickson's offer of £5,000 lapses at the end of this month, and as he has had no information from Australia that the remainder of the £15,000 is secured, he has probably made up his mind that the whole scheme has fallen through, as did the similar proposal a few years ago. Indeed, it would seem as if Baron Dickson had not been treated with the courtesy which might have been expected. He had not been informed of the progress of matters in Australia, and has received no certain information as to the actual state of the movement. The fact is, the movement seemes to have been sadly mismanaged. No proper steps have been taken to enlist the sympathies and the active support of the public in Australia, where there is plenty of money to spare for purposes of this kind. True, one or two newspapers appear to have supported the proposal with some energy, but much more is wanted than that in Australia, where evidently the public is not too enthusiastic for the promotion of knowledge. The leaders of the movement on behalf of the proposed Antarctic expedition seem to have been a few members of learned societies, not quite in touch with the general public. The result is that the wealthy Australian colonies have been placed in the ridiculous position of having appealed to a small nation like Sweden for assistance, and in the end have

been unable to fulfil the conditions on which that assistance was asked. It is to be hoped that it is not yet too late to lead the movement to a more worthy result.

— The *Telegram Herald* of Grand Rapids says that the tallest men of Western Europe are found in Catalonia, Spain; Normandy, France; Yorkshire, England; and the Ardennes districts of Belgium. Prussia gets her tallest recruits from Schleswig-Holstein, the original home of the irrepressible Anglo-Saxons; Austria from the Tyrolese highlands. In Italy the progress of physical degeneration has extended to the upper Appennines, but the Albanian Turks are still an athletic race, and the natives of the Caucasus are as sinewy and gaunt as in the days of the Argonauts. In the United States the thirty-eighth parallel, ranging through Indiana and northern Kentucky, is as decidedly the latitude of big men as the forty-second is that of big cities. The tallest men of South America are found in the western provinces of the Argentine Republic, of Asia in Afghanistan and Kaypooana, of Africa in the highlands of Abyssinia.

— A correspondent of the *Times of India*, referring to recent long fasts in this country, says that in India fasts of thirty to forty days are common among the Jains, from among whom, once in each year, some individual comes forward and undertakes to fast thirty-five, forty, and even sixty days. They do this with nothing but warm water to drink, and will die rather than take food during the prescribed period. Quite recently two Jains of Bombay fasted, one for sixty-one, the other for forty-eight days, at the end of which time, having been congratulated by twenty-five thousand Jains who went for the purpose, they recommenced taking food in the manner prescribed in their own books and shastras. On Sept. 22, in commemoration of this event, all the chief bazaars in Bombay were closed, and about five thousand Jains, male and female, fasted all day, while a large sum was spent in securing the release of cows and other animals from the slaughter house at Bandora.

— At a meeting of the Chemical Society of Washington, Dec. 10, Professor Wiley and W. H. Krug presented papers on the "So-called Floridite." Professor Wiley described the location and the occurrence in Florida of the samples which had been sent him by Professor Cox. Some of the specimens, he said, were amorphous masses of almost pure tri-calcium phosphate, others were mixtures, but containing chiefly that compound. He thought it ought not to be defined as a mineral species. He said undue importance had probably been ascribed to commercial fertilizers as plant foods, as experience has demonstrated that mineral phosphates are not readily absorbed by plants even when in a finely divided state, but need to be decomposed by the action of sulphuric acid. The most refractory phosphates, however, with plenty of time are utilized by the plants. Florida phosphates seemed especially capable of assimilation in the natural state, and experiments in the use of the natural product were now going on at the sugar station of Runymede, Florida. Mr. Krug spoke of the methods of analysis, gave details of the process as described at a previous meeting, and presented the results of the analyses (Dr. T. M. Chatard, "Notes on the Analyses of phosphate rocks"). He agreed with Professor Wiley as to the non-existence of floridite as a definite species. His paper referred mainly to the determination of fluorine in phosphate rocks, and the method employed is a modification of the Boezelius silica fusion method. Instead of using ammonium carbonate to remove silica and alumina from the alkaline solution, the saturation of the solution with carbonic acid under pressure has been found to give very satisfactory results. He had reason to think that the method might be still further simplified. Discussion of the two papers was by Professor Clarke and Dr. Schneider. Professor Clarke thought the determination of a mineral species did not depend upon crystallization, as many amorphous minerals, such as torquois, serpentine, and talc were good species Whether it is a distinct chemical compound, is the best basis of determination. If among the phosphates is found a tri-calcium phosphate by itself, he thought it ought to be a mineral species, no matter what its derivation. Dr. Schneider described a series of analyses he had made to determine the influence of different quantities of fluorine on the loss of silica when evaporated with varying amounts of liquid. In a paper on "Meat Preservatives," I. T. Davis gave the following list of preservative agents: salt, potassium nitrate, sulphurous acid, benzoic acid, saccharine, salycilic acid, hydro-napthole. The author described their action and the means of their detection. W. F. Hillebrand and Wm. H. Melville presented a paper "On the Isomorphism and Composition of Thorium and Uranous Sulphates."

— A meeting was held in the Lecture Room of the Brooklyn Institute, 502 Fulton Street, on Saturday evening, Dec. 26, at eight o'clock, for the purpose of organizing a Brooklyn Numismatical Society as a Section of the Brooklyn Institute. The purposes of the society will be the collection of coins, medallions, and kindred works of art, the conduct of courses of lectures on numismatics, the formation of a library of reference on the subject, and to enable students and specialists in numismatology to become better acquainted with one another. Dr. Charles E. West, president of the Archæological Society of the Institute, gave a brief illustrated lecture on "Ancient Coinage" after the organization of the section.

— In the interesting paper on insectivorous plants, read before the Royal Horticultural Society on Sept. 22, 1891, and reported in *Nature*, Mr. R. Lindsay refers to the experiments by which Mr. Francis Darwin has shown the amount of benefit accruing to insectivorous plants from nitrogenous food. Mr. Lindsay says his own experience in the culture of Dionæa is that when two sets of plants are grown side by side under the same conditions in every respect, except that insects are excluded from the one and admitted to the other, the latter, or fed plants, are found to be stronger and far superior to the former during the following season. He points out the importance of remembering that the natural conditions under which these plants are found are different from what they are under cultivation. In their native habitats they grow in very poor soil and make feeble roots, and under these conditions may require to capture more insects by their leaves to make up for their root deficiency. Under culture, however, fairly good roots for the size of plant are developed. "Darwin," says Mr. Lindsay, "mentions that the roots of Dionæa are very small: those of a moderately fine plant which he examined consisted of two branches, about one inch in length, springing from a bulbous enlargement. I have frequently found Dionæa roots six inches in length; but they are deciduous, and I can only conjecture that the roots mentioned by Darwin were not fully grown at the time they were measured. What is here stated of the natural habits of Dionæa applies more or less to all insectivorous plants."

— At a recent meeting of the New York Academy of Medicine a popular address was delivered by Professor Charles F. Chandler on "Arsenic in Common Life." In this address, as reported in *Medical News*, he devoted himself to the task of exploding the widely prevalent idea, both in lay and professional circles, concerning the dangers from arsenic in wall-paper. He said that he had himself believed in it without ever making any special investigation, up to the time when his duties in connection with the Board of Health required him to make it a special study. He then found that the idea had been started by a botanist, and that it was based on the most flimsy reasoning. He next made some experiments in the laboratory by passing air over sheets of paper —some moist and others dry—coated with Paris green. Not a trace of arsenic was found in this air. Much of his address was devoted to a narration of cases that had occurred in Boston during a time when the people in that city were much excited over the supposed dangers from arsenical wall-paper. The most important case was that of an ex-mayor of Boston, who had been supposed to be suffering for a long time from this form of poisoning, but the post-mortem examination showed that he had died from cancer of the stomach. The wall-paper that had been supposed to be the source of the poisoning in his case had not been changed from 1817 to 1891. While it is quite possible that, in the old-fashioned wall-paper, the arsenical dyes were loosely attached to the paper, the arsenic might become detached and diffused through the air, the amount would ordinarily be quite insignificant; and in the wall-papers made in the last fifteen years no arsenical pigments have been used, and the presence of arsenic in

these papers, as determined by delicate chemical tests, is due entirely to accidental impurities. Some of the papers that were thought to have caused poisoning had been on the walls for thirty or forty years. Supposing, for the sake of argument, that there were sixty square yards of paper in a room, each yard containing one grain of arsenic—the amount found in several of the cases quoted—and that during a period of thirty years *all* the arsenic had left the wall-paper and had entered the human system without any being lost, this would be at the rate of one grain in six months, or only $\frac{1}{180}$ of a grain in each twenty-four hours. Many distinguished scientists have independently investigated this subject of poisoning from arsenical wall-paper, and they all agree in saying that there is "nothing in it."

— The *Meteorologische Zeitschrift* for November contains a summary, by Dr. J. Hann, of the meteorological observations taken at Cairo from 1863–88. The observations have been published *in extenso*, together with a good introduction upon the climate, in the Bulletin of the Egyptian Institute, and although similar observations have occasionally been published before, the present series contains much new and useful material. The most striking feature in the climate of this part of Egypt, as we learn from *Nature*, is the *Chamsin*, the hot and dust-bearing wind which makes its appearance in March or April for about three to four days at a time, and robs a large portion of the trees of their leaves. In the intervals during which this wind is not blowing the weather is pleasant and clear during spring-time, and the nights fresh and calm. During the summer the north winds prevail, with high temperature, very clear air, and great dryness. Towards September humidity appears with the rise of the Nile, the ground is at times covered with heavy dew, and the heat becomes oppressive on account of the moisture. In October and November fog occasionally occurs in the morning, and rain begins to fall. After this season the temperature is uniform and pleasant. Snow is unknown, frost very seldom occurs, and rain is not very frequent. The absolute maximum temperature of the 21 years' period was 117° in August, 1881, which was also closely approached in May, 1880, viz., 116.4°. The absolute minimum was 28.4° in February, 1880, and the mean annual temperature was 70.5°. Rainfall is only given for the years 1887–88, in which 0.87 and 1.67 inches fell respectively. The relative humidity sinks at times even on a daily average to 12 per cent, and has been known to fall as low as 3 per cent at certain hours. Thunder-storms and hail are very rare. The original work contains a long investigation on the connection between the height of the Nile and the weather, a comparison between the present climate and that at the beginning of this century, and several carefully prepared diagrams referring to all meteorological elements.

— At the monthly meeting of the Royal Meteorological Society, Dec. 16, Mr. W. Marriott gave the results of the investigation undertaken by the society into the thunder-storms of 1888 and 1889, which he illustrated by a number of lantern slides. The investigation was originally confined to the south-east of England, but as this district was found to be too circumscribed, it became necessary to include the whole of England and Wales. After describing the arrangements for collecting the observations and the methods adopted for their discussion, Mr. Marriott gave statistics showing the number of days on which thunder-storms occurred at each station; the number of days of thunder-storms in each month for the whole country; the number of days on which it was reported that damage or accidents from lightning occurred; and also the number of days on which hail accompanied the thunder-storms. In 1888 there were 113 days and in 1889 128 days on which thunder-storms occurred in some part of the country. The number of days with damage by lightning was 33 in 1888 and 38 in 1889; and there were 56 days in each year on which hail accompanied the thunder-storms. The tables of hourly frequency show that thunder-storms are most frequent between noon and 4 P.M., and least frequent between 1 A.M. and 7 A.M. Thunder-storms appear to travel at an average rate of about 18 miles per hour in ill-defined low barometric pressure systems, but at a higher rate in squally conditions. The author is of opinion that individual thunder-storms do not travel more than about 20 miles; and that they take the path of least resistance, and are consequently most frequent on flat and low ground. Detailed isobaric charts, with isobars for two-hundredths of an inch were prepared for 9 A.M. and 9 P.M. each day for the month of June, 1888. An examination of these charts showed that instead of the pressure being so very ill-defined, as appeared on the daily weather charts, there are frequently a number of small, but distinct areas of low pressure, or cyclones, with regular wind circulation; and that these small cyclones passed over the districts from which thunder-storms were reported. Sometimes it is not possible to make out well-formed areas of low pressure from two-hundredths of an inch isobars, but there is a deflection of the wind which shows that there is some disturbing cause; and thunder-storms have usually occurred in that immediate neighborhood. The author believes that the thunder-storm formations are small atmospheric whirls, in all respects like ordinary cyclones; and that the whirl may vary from 1 mile to 10 miles or more in diameter. There are frequently several whirls near together, or following one another along the same track. The numerous oscillations in the barometric curve are evidently due to the passage of a succession of atmospheric whirls; and it appears that lightning-strokes are most frequent when these oscillations are numerous. Mr. F. J. Brodie read a paper "On the Prevalence of Fog in London during the Twenty Years 1871 to 1890." The popular notion that November is *par excellence* a month of fog is not confirmed by the figures given by the author. The number of fogs in that month is, if anything, slightly less than in October or January, and decidedly less than in December, the last-mentioned month being certainly the worst of the whole year. The latter part of the winter is not only less foggy than the earlier part, but is clearer than the autumn months. In February the average number of days with fog is only 6.6, as against 8.9 in January, 10.2 in December, 9.2 in October, and 8.8 in November.

— A paper on "Siouan Onomatopes," by J. Owen Dorsey, was read before the Anthropological Society of Washington, D.C., Dec. 1, 1891. According to "The Century Dictionary," "an onomatope is a word formed to resemble the sound made by the thing signified." Mr. Dorsey finds in the Siouan languages many onomatopetic roots, hence he suggests the modification of the definition just given, making it read, "An onomatope is a word *or root* formed to resemble the sound made by the thing signified." In the paper under consideration, the author gives examples of onomatopes in seven languages of the Siouan or Dakotan family: Dhegiha, Kwapa, Kansa, Osage, Tciwere, Winnebago, and Dakota, all but the Dakota having been collected by himself since 1871. In these languages, according to the author, there are sundry permutations of sound, among which are *sh* and *kh*, *gh* and *z*, *dh* and *n*. The words in which these permutations occur are not always synonyms; but when we find a word in which, for example, *sh* is used, we may safely infer that the language contains another word differing from the former only in the substitution of *kh* for *sh*, or that one language or dialect uses *sh* where another employs its correlative, *kh*. Most of the onomatopes found by the author are dissyllabic, a few being monosyllabic and polysyllabic. Some of the onomatopes were given with the notations of their respective sounds as they appear to the Indian ear; thus, the sound of the plane and drawing-knife (*s-s-s*) becomes the root *s'u*; whence the verbs, *ba-s'u*, to use a plane; and *dhi-s'u*, to use a drawing-knife. The sound of a waterfall, of sawing wood, etc., is *kh* + (a prolonged sound), the onomatope being *khu'-'e* in Dhegiha, *khu'-wa-dᵉʰe* in Kansa, *khu'-we* in Kansa and Osage, *kho'-kh'e* in Tciwere, and *sho* + *kh* in Winnebago (the *o* in the last being prolonged). The creaking of new shoes or the sound of fiddle-strings (*gi-gi-gi*) evidently suggested the root *gi'-ze*; whence *ba-gi'ze*, to play a fiddle; and *nan-gi'ze*, to make (new shoes) creak by walking (in them). Many other examples were given; but the reader is referred to the *American Anthropologist* for January, 1892, for the full article.

— Among the recent appointments of Johns Hopkins graduates are Alfred Bagby, Jun. (Ph.D., 1891), adjunct professor of ancient languages, South Carolina College; Edward A. Bechtel (A.B., 1888), professor of Latin, Yankton College, South Da-

kota; Hiram H. Bice (A.B., 1889), instructor of languages, Blackburn University, Carlinville, Ill.; Richard N. Brackett (Ph.D., 1887), associate professor of chemistry, Clemson Agricultural College, S.C.; J. Douglas Bruce (graduate student, 1889–90), associate in Anglo-Saxon and Middle English, Bryn Mawr College; Norman W. Cary (graduate student, 1889–91), instructor in biology, geology, and astronomy, Wilson College, Chambersburg, Pa.; Frank A. Christie (fellow, 1885–86), lecturer on New Testament literature, Harvard Divinity School; Henry L. Coar (graduate student, 1884–86), mathematical master, Smith Academy, Washington University, Mo.; Charles Edward Coates, Jun. (A.B., 1887, Ph.D., 1891), professor of chemistry, St. John's College, Md.; John R. Commons (graduate student, 1888–90), associate professor of political economy, Oberlin College; Starr W. Cutting (graduate student, 1890–91), professor of French and German, Earlham College; L. Bradley Dorr (A.B., 1890), adjunct professor of chemistry, Niagara University, Buffalo, N.Y.; Hermann L Ebeling (A.B., 1882, fellow, 1890, Ph.D., 1891), professor of Greek, Miami University; William A. Eckles (graduate student, 1889–91), professor of Greek, Ripon College; George S. Ely (fellow, 1881–83, Ph.D., 1883), principal examiner, U. S. Patent Office; Alfred Emerson (fellow, 1882–84, instructor, 1884–85), associate professor of classical archæology, Cornell University; Andrew Fossum (Ph.D., 1887), classical instructor, Drisler school, New York City; William R. Fraser (graduate student, 1888–91), instructor in classics, University of Nebraska; Thomas P. Harrison (fellow, 1890-91, Ph.D., 1891), associate professor of English, Clemson Agricultural College, S.C; Arthur S. Hathaway (fellow, 1882–83), professor of mathematics, Rose Polytechnic Institute; George A. Hench (fellow, 1888–89, Ph.D., 1889), assistant professor of Germanic philology, University of Michigan; Charles C. Henschen, (graduate student, 1890–91), instructor in Girard College, Philadelphia; Benjamin C. Hinde (graduate student, 1888–90), professor of physics, Trinity College, N.C.; Clifton F. Hodge (fellow, 1888–89, Ph.D., 1889), instructor of biology, University of Wisconsin; Walter J. Jones (A.B., 1888, Ph.D., 1891), professor of chemistry, Wittenberg College. O.; Henry W. Keating (A.B., 1891), principal, Centreville Academy, Md.; Andrew C. Lawson (fellow, 1886–87, Ph.D., 1888), assistant professor of geology and mineralogy, University of California; Frederick S. Lee (fellow, 1884–85, Ph.D., 1885), demonstrator of physiology, College of Physicians and Surgeons, N.Y.; Felix Lengfeld (fellow, 1887–88, Ph.D., 1888), instructor in chemistry, University of California; A. Stanley Mackenzie (fellow, 1890–91), lecturer in physics, Bryn Mawr College; Arthur W. McDougall (A.B., 1891), financial secretary, Associated Charities of Cincinnati; John H. T. McPherson (A.B., 1886, fellow, 1889–90, Ph.D., 1890), professor of history, University of Georgia; W. Howard Miller (A.B., 1888), instructor in mathematics, Leland Stanford University; Thomas H. Morgan (fellow, 1889–90, Ph.D., 1890, Bruce fellow, 1890–91), associate professor of biology, Bryn Mawr College; Wilfred P. Mustard (fellow, 1890 91, Ph.D., 1891), professor of Latin, Colorado College; Charles A. Perkins (fellow, 1883–84, Ph.D., 1884), professor of physics, Hampden Sidney College; E. D. Preston (fellow, 1876–78), is engaged at Honolulu, probably for a year, working under the joint auspices of the International Geodetic Association of Europe and the U. S. Coast and Geodetic Survey; Herbert E. Russell (graduate student, 1886–87), associate professor of mathematics and natural sciences, University of Denver; A. Duncan Savage (fellow, 1876–79), instructor in the history of art, Farmington, Conn.; Edward M. Schaeffer (graduate student, 1883–85), professor of physical culture, Washington and Lee University; Henry Sewall (fellow, 1878–79, associate, 1879–82, Ph.D., 1879), professor of physiology, University of Denver; Sidney Sherwood (Ph.D., 1891), instructor in finance, University of Pennsylvania; Ernest G. Sihler (fellow, 1876–79, Ph.D., 1878), professor of ancient languages, Concordia College, Milwaukee; Henry D. Thompson (fellow, 1886–87), assistant professor of mathematics, Princeton College; William L. Weber (graduate student, 1890–91), professor of English, Southwestern University, Texas; Benjamin W. Wells (fellow, 1881), professor of modern languages, University of the South; John White, Jun. (A.B., 1888, fellow, 1890–91, Ph.D., 1891), assistant in chemistry, Cornell University; Henry V. Wilson (A.B., 1883, fellow, 1887–88, Ph.D., 1888, Bruce fellow, 1888–89), professor of biology, University of North Carolina; Edmund B. Wilson (fellow, 1879–80, Ph.D, 1881, assistant, 1881–82), adjunct professor of biology, Columbia College; John R. Wightman (fellow, 1886–87, Ph.D., 1888), associate professor of romance languages, University of Nebraska; Arthur C. Wightman (fellow, 1887–88, Ph.D., 1889, demonstrator, 1889–90), assistant professor of biology, Randolph Macon College.

— Professor Stas, the eminent Belgian chemist, has died at the age of seventy-eight.

— According to information sent to Berlin, says the *Times*, Emin Pasha and Dr. Stuhlmann, travelling in the region between Lakes Victoria, Tanganyika, and Albert Edward, have discovered what they take to be the ultimate source of the Nile. This is a river called Kifu, which is supposed to have its sources in the Uhha country, lying to the east of the northern part of Lake Tanganyika, about 4° of south latitude. It flows into the southern end of Lake Albert Edward. It is not stated that Emin and Dr. Stuhlmann have actually followed the course of the river. They have no doubt encountered it on their journey from Victoria Nyanza towards the other lake and followed it down to its mouth. If the course which they lay down for it is correct, it will compel us to alter the hydrography on our maps of this region. There is no mention of the Lake Kifu, between Tanganyika and Albert Edward, to be found in existing maps; and it is well known that the African natives rarely distinguish between a river and a lake,—Nyanza, in the language of Central Africa, standing for both. The still larger lake, Akanyaru, or Alexandra Nyanza, as Mr. Stanley named it, may very probably also have to be removed. No white traveller, so far as is known, has ever seen it; Mr Stanley placed it down on his map from native report. It may simply be an expansion of the Kifu, and not the source of the Kagera, which flows into the west side of Victoria Nyanza. The Kagera will thus lose much of its importance as a remote feeder of the Nile, and the Kifu may possibly become its most southerly source. But it should be remembered that when Mr. Stanley was marching northwards to the Victoria Nyanza in his great journey across Africa, he came upon a river in about 5° south latitude which he believed flowed into the south shore of the lake under the name of Shimeeyu. Mr. Stanley struck this river at only one or two points, and these may really have belonged to different rivers. At all events, on the most recent maps the Shimeeyu is sharply deflected to the east from its mouth in the lake, and there is no river rising in 5° south latitude, which flows into the Victoria Nyanza. Probably we have not heard the last word about the ultimate sources of this strange river, about the position of which Ptolemy, after all, was not so far wrong. We have first the Kifu rising in about 4° south latitude, running into Lake Albert Edward, issuing thence as the Semliki, and feeding Lake Albert. There it mingles with the Victoria Nile from Lake Victoria, and together they issue from Lake Albert as the White Nile, which, before it reaches Khartoum, is augmented by a multitude of tributaries from the west. Whether the Shimeeyu or the Kifu be its most remote southern feeder, the river flows through 36 degrees of latitude. The full details of this journey of Emin will be awaited with interest, especially if he continues to fill in the blanks on our maps and to complete our knowlege of one of the most remarkable rivers of the world.

— Professor Thomas F. Hunt of the Pennsylvania State College has accepted the invitation to occupy the chair of agriculture in the Ohio State University after Jan. 1, 1892.

— Dr. E. von Esmarch, son of Professor v. Esmarch of Kiel, has been appointed professor of hygiene in the University of Königsberg, in the room of Professor C. Fränkel, who has gone to Marburg.

— Mr. Robert P. Bigelow (S B., Harvard University, 1887) has been appointed to the Adam T. Bruce fellowship in biology, in place of Dr. Thomas H. Morgan, who has resigned the fellowship to accept the position of associate professor of biology at Bryn Mawn College.

SCIENCE:

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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

THE KLAMATH NATION.

I.—THE COUNTRY AND THE PEOPLE.

"THE Klamath Indians of South-Western Oregon" is the second title of the recently published work, by Albert Samuel Gatschet, which forms, according to its leading title, Vol. II. of "Contributions to North American Ethnology," one of the several series of works issued by the "United States Geographical and Geological Survey of the Rocky Mountain Region, J. W. Powell in Charge." The term "volume," however, is in this case to be understood in a special sense. The work really appears in two substantial tomes in quarto, comprising over seven hundred pages each, and distinguished as Parts I. and II. The too brief "table of contents" informs us that Part I. contains the writer's "letter of transmittal," and an "ethnographic sketch," with "texts," and "grammar;" while Part II. is entirely occupied by the "Dictionary—Klamath-English, and English-Klamath." This curt statement gives but a slight idea of the importance of the work as a contribution of the first order to ethnological science.

The Klamath River rises in the southern interior of Oregon, at a distance of about three hundred miles from the Pacific. First traversing an extensive morass, known as Klamath Marsh, it passes through Upper Klamath Lake, a charmingly picturesque sheet, some twenty-five miles long by five or six miles in breadth; then receiving a tributary from the Lower Klamath Lake, it crosses the State boundary into California, and, after a winding course of two or three hundred miles, falls into the ocean near the north-eastern angle of that State. Several tribes of different lineage and languages dwell, or formerly dwelt, along this stream, and have borne indiscriminately from the river's name (the origin and meaning of which are uncertain) the appellation of Klamath Indians But this designation is more usually restricted to the people who possess the upper waters of the river and the great Klamath Lake, and who, as is the case with many other Indian tribes, have no special distinguishing name for themselves except that of "man,"— in their language, *Maklaks*. Another name which has been given to them is *Lutuami*, meaning Lake Indians, which is in no way distinctive. The author has therefore judiciously decided to retain the usual appellation, "the Klamath Indians," adding the description "of South-western Oregon," to distinguish them from the Californian Klamaths. As these, however, have their proper tribal names of Shasti, Karok, Hupa, and Yurok or Alikwa, it is likely that the designation of Klamath will in time be wholly restricted to the Oregon nation bearing this name.

The title of "nation" is one which, as the author suggests in his "letter of transmittal" to Major Powell, may properly be conferred upon this remarkable people. Their claim to this title does not reside in their numbers, which at present hardly reach nine hundred souls, nor in their territory, though this, even in their diminished reservation, covers fifteen hundred square miles. But they have the distinction, like the Basques of south-western Europe, of composing a separate "stock," possessing a language, a mythology, and a social system peculiar to themselves. Such a stock, inhabiting a compact territory, and having (as the Klamaths had till lately) their own government, may justly claim to be considered a nationality. The claim, however, is in America not so notable as it would be deemed in Europe, where distinct linguistic stocks are so few. Mr. Gatschet gives a list of twenty-two of these stocks, radically distinct in grammar and vocabulary, which have been found in Oregon and California alone. If to these we add the stocks of Washington State and of British Columbia, the number of such aboriginal nations found along the Pacific coast of North America will not be less than twenty-eight, nearly equalling the total number of stocks in Asia and Europe combined. There is reason to believe that a careful study of the immensely varied languages, physical and moral traits, mythologies, and social systems of these twenty-eight primitive nationalities would greatly modify and in some respects transform the sciences of ethnology and linguistics. There have been many partial and fragmentary attempts at such a study, some of them possessing much value. But that of Mr. Gatschet is undoubtedly the fullest and most minutely accurate that has thus far been made of any single stock.

The Klamath country is a region of mountains, lakes, and upland plains, stretching eastwardly into the interior from the lofty "Cascade Range," and elevated from four to seven thousand feet above the level of the sea. The author was naturally reminded of his native Switzerland by the grandeur of the scenery in the western portion of the reservation, "where the towering ridge of the Cascade Mountains and the shining mirrors of the lakes at their feet confront the visitor, surprised to see in both a reproduction of Alpine landscapes in the extreme west of America." It might be added that in the people themselves we recognize the well-known traits of mountaineers, as we trace them from the Scottish Highlands to Montenegro, and from the Caucasus to the Pamir,— the intense local attachment, the spirit of independence, the desperate bravery in the defence of their homes, the frugality, and the strong conservatism.

The Klamath people are divided into two septs, the Klamath Lake tribe, who call themselves Eukshikni ("of the lake") and the Modocs, who twenty years ago acquired a dismal notoriety by the "tragedy of the Lava Beds,"—an event, or series of events, which aroused horror at the time, but in which, according to the judgment of the best-informed historians, including Mr. Gatschet, they were more sinned against than sinning. An eminently fair-minded historical writer, Mr. J. P. Dunn (author of "The Massacres of the Mountains"), in his account of the Modoc outbreak, gives a pithy and graphic description of this sept, in terms which,

with some modification, will apply to the whole nation. "They were a peculiar people; good-natured as a rule, but high-tempered; industrious, and yet as haughty as the laziest Indians on the continent. They had more of that commendable pride which makes men desire to be independent and self-respecting than any of their neighbors. They were inclined to be exclusive in their social relations, but even among themselves there was little merrymaking. They took a more serious view of life and its duties. Stubbornness and strong will were tribal characteristics. In features they were rugged and strong, the cheek-bones large and prominent, the hair thick and coarse, the face heavy and not much wrinkled in old age." Of their congeners, the "Upper Klamaths," the same writer says, "They were a finely formed, energetic, and cleanly race." Mr. Gatschet confirms in general these descriptions, but adds: "The Mongolian features of prognathism and of high cheek-bones are not very marked in this upland race, though more among the Modocs than in the northern branch. If it were not for a somewhat darker complexion and a strange expression of the eye, it would be almost impossible to distinguish many of the Eukshikni men from Americans." Their complexion is so nearly white that "blushing is easily perceptible, though the change in color is not great." The hair is straight and dark; and he remarks, "I did not find it very coarse, though with many Modoc women it is said to be so, and to grow to an extreme length."

It is worthy of note that the complexion and other physical characteristics of the Indians of western America vary in marked connection with the "environment," that is, with the climate, food, and mode of life. The natives of northern British Columbia, the Thlingits (or Thlinkeets) and Haidas, are as light of hue as Europeans. They often have ruddy cheeks, brown or blue eyes, and red or brown and wavy or curly hair. As we pass southward along the coast, successively to the Nootkans, the Chinooks, and the other tribes of southern British Columbia, Washington, Oregon, and northern California, we find the hue of the skin deepening, the eyeballs darkening, and the hair becoming coarser, until at length, under the tropical heats of central and southern California we come to tribes with almost negroid traits. These traits are described by the best authority, Mr. H H. Bancroft, as "a complexion much darker than that of the tribes further north, often very nearly black;" "matted bushy hair;" "a low, retreating forehead, black, deep-set eyes, thick, bushy eyebrows, salient cheek-bones, a nose depressed at the root and somewhat wide spreading at the nostrils, a large mouth, with thick, prominent lips, teeth large and white, but not always regular, and rather large ears." But when we recede from the low, hot, and moist coast to the cool and dry interior uplands, the people, as in the case of the Klamaths, return to the European type. Mr. Gatschet describes particularly the small mouth of the Eukshikni, the good teeth, and the genuine Grecian profile, "the nasal ridge not aquiline but strong, and forming an almost continuous line with the forehead."

The truth is that, as one of the acutest of German anthropologists, Oscar Peschel, in his able and comprehensive treatise on the "Races of Man," has affirmed, all attempts to distinguish the various so-called races by merely physical characteristics, whether of color, hair, or the osseous framework, have proved utterly futile. As regards the shape of the head, on which so much stress has been laid, the view maintained by the late S. G. Morton, that the natives of this continent had a peculiar form of cranium, different from that of any other people, has been shown, first by Sir Daniel Wilson in his "Prehistoric Man," and later by Dr. Virchow, in his recent work, "Crania Ethnica Americana," to be wholly incorrect. Dr. Virchow declares (in his summary read before the Congress of Americanists, at Berlin, in 1888) that he finds dolichocephalic, mesocephalic, and brachycephalic tribes scattered throughout the continent; and he pronounces in positive terms his conviction that "the cephalic index, calculated on measures of the length and breadth of the cranial vault, should not be admitted as a determining proof of the single or diverse origin of populations."

We may confidently anticipate that the series of physical measurements of all the American tribes, which, by a happy thought, Professor Putnam has instituted for the Columbus World's Fair, and on which many observers are now engaged, under the experienced supervision of Dr. Franz Boas, will result in confirming the views of Peschel, Wilson, and Virchow, and establishing the truth that physical characteristics afford no proper tests of racial affinity or diversity. We are thus brought back to the older, and, as time has proved, the infinitely stronger evidences of what may be styled the intellectual characteristics, language and mythology. That these tests sometimes fail, through mixture of stocks and adoption of foreign beliefs, is unquestionable; and we are then left in ethnology, as we are often left in other sciences — astronomy, geology, and physiology, for example — to rely on probabilities. But so far as certainty is attainable, as it often is, it can only be attained through the evidence of these special tests.

The language and mythology of the Klamath nation are of a highly interesting character; but our study of these subjects, with the ample materials and philosophic suggestions furnished by Mr. Gatschet, must be left for other articles.

HORATIO HALE.

Clinton, Ontario, Canada.

ANOTHER RIVER-PIRATE.

IN *Science*, vol. xiii., 1889, p. 108, under the title of "A River-Pirate." Professor W. M. Davis described a recent case of river capture in south-eastern Pennsylvania, brought about by the backward gnawing of one stream into the drainage area of another. In looking over with him the Doylestown sheet of the Pennsylvania Topographic Survey there were found numerous cases of similar capture, either already accomplished or about to take place, and at his suggestion the writer recently made a visit to the district in question, in the hope of being able to add something more to the history of the rivers of Pennsylvania.

The region of these migrations, Buck County, is situated in the north-eastern part of Pennsylvania (see Fig. 1), and extends for thirty-three miles (in a straight line) along the Delaware River. It is a gently rolling, well-cultivated country, composed of Mesozoic new red sandstones and shales, dipping from 5° to 15° to the north-west, the hard and soft layers of reddish sand and mud alternating. The evidence goes to show that the surface of the country has been reduced by erosion at least 1,000 feet since the time when the beds were laid down, for the upper deposits must have once overspread the gneiss ridge at the northern county line. They still rise nearly to its top, and there is no evidence of a fault, the absence of any trace of it being capable of explanation only on the supposition that extensive erosion has taken place.[1]

[1] 2d Geol. Survey of Penn. 1885.

The evidence from New Jersey and Pennsylvania goes to show that after the tilting of the sandstones there came an extensive period of denudation, which resulted in the production of a more or less perfect plain, the so-called Cretaceous base-level, which can be seen in the level tops of the New Jersey Highlands and of the ridges of Pennsylvania. Following this came an elevation, giving the streams renewed energy, and resulting in the etching out of the softer rocks down to another peneplain, the Tertiary base-level. Finally another elevation gave the streams another period of activity, and it is in this cycle that we find them to-day. The larger streams, like the Delaware, have already sunk

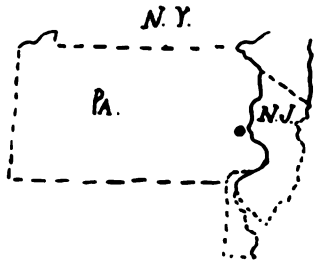

FIG. 1.

their channels well into the Tertiary peneplain. It is with some of the smaller ones that we have now to deal.

Unless something had occurred to interfere with their work in the previous cycle, which ended in the production of the Tertiary peneplain, the streams of this district should now be well adjusted to the structure. On examining the map, however, we find that many of them show a tendency to deflect downstream as they run towards the Delaware. Such an arrangement is characteristic of the tributaries of flood-plained master-streams, as is well shown in the case of the Mississippi and the Po, and may perhaps be explained in this case by the flood plaining of the Delaware during the Tertiary period of base-levelling. Had such a flood-plaining occurred before, i.e., during the Cretaceous base-levelling epoch, the side streams would have already become adjusted to the structure, for since Cretaceous time the whole surface of the country has been worn down some hundreds of feet. Flood-plaining such as that believed to have taken place here, seems to be characteristic of large rivers during the last stages of base-levelling, when, with a very gentle slope, they build their deltas up-stream from their mouths, covering the country on both sides with alluvium.[1]

The flood-plaining of the Delaware would give the side-streams a superimposed course on the Tertiary peneplain, and as they cut down through the cover they would find themselves flowing across the outcropping edges of the underlying strata of sandstone and shale. An arrangement of strata such as that here presented gives an admirable field for the adjustment of streams. It can be readily seen that if a side stream works back along the strike of one of these beds, it has, especially if the bed is soft, a much easier course than a stream which has to cross the edges of many hard and soft strata on its way to join the master. Perhaps this may be more easily understood from the accompanying figure (Fig. 2), reduced from the contoured map of the Pennsylvania Geological Survey, representing the district under consideration.

[1] W. M. Davis: "The Geological Dates of Origin of Certain Topographic Forms on the Atlantic Slope of the United States" (Bulletin Geol. Soc. of America, Vol. 2, p. 590); "The Rivers and Valleys of Penn." (Nat. Geog. Mag., Vol. 1, No. 3); "The Geographic Development of Northern New Jersey" (Proc. Boston Soc. Nat. Hist., XXIV., 1889).

In this case Tohickon Creek, only the lower part of which is shown, has its course directly across the strike of the beds down to the Delaware, while Tinicum Creek goes along the strike for some distance and thus has an easier course. The result has been that a branch of the Tinicum has gnawed its way back along the strike until it is now within less than half a mile of the Tohickon. The Tohickon has a descent of somewhat over twenty feet in the first mile from this point, while the branch of the Tinicum falls over eighty feet in the same distance. The distance from the present divide to the Delaware is about eight miles along the Tohickon, and about five miles along the Tinicum. It is seen, then, what an advantage the little branch of the Tinicum has over its larger rival. The region where the contest is going on is just south of the letter *A* in the figure, and as the more favored stream works its way further and further back, the divide will be pushed over the intervening space, and before long the Tohickon will be captured and led out by a shorter and better course through the Tinicum, leaving its lower part, beheaded, to continue its way down the Tohickon valley. The region of the divide is pretty level, being all enclosed by the 300 feet contour, with a slight slope toward the Tohickon, and a greater one toward the Tinicum, and if we get this idea of migration clearly in mind, it seems almost as if we could see the divide moving toward the Tohickon. There are few trees to protect the surface there, and the crops of potatoes and corn which cover the fields give a good opportunity for the rain to carry away the soil.

What is about to take place in the case of the Tohickon, seems to have already happened further to the east. Here again the Tinicum is the pirate. A glance at the figure will make plain the state of the case. If the Tinicum is followed

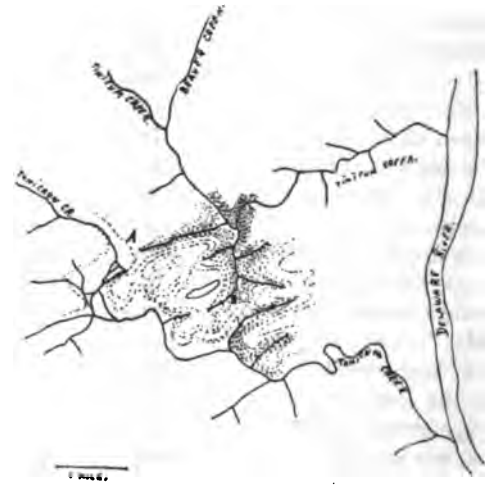

FIG. 2.

down its course to the Delaware it will be seen to make a sharp turn to the north-east just at the point where its pirate tributary comes in from the south-west. Knowing, as we do, that the easier course lies along the strike of the beds and not across it, we naturally turn to this point to see what has taken place. If on coming down the Tinicum to this point we continue to the south, we go for some distance up a small stream flowing north, which comes down to the Tinicum through a deep and rather narrow valley. Continuing our walk along this creek, we soon come to a little sheltered nook, where a picturesque farm-house stands, past which the creek flows, coming in from the south-west. We now leave the latter, and continue up a hollow to the south-east, and across

some fields, gently sloping towards a depression in the middle, until we reach another little creek, flowing south into the Tohickon. The explanation of this seems to be as follows: Beaver Creek originally flowed out to the south-east, across the present divide, into the Tohickon, having a similar course to that of the Tohickon in that it crossed the strike of the beds. Tinicum Creek, gnawing along its easier path, reached and captured Beaver Creek, at the point where the sharp turn is seen. The divide which originally stood close to the Tinicum has now been pushed south until it occupies a position close to the letter *B* in the figure.

The beheaded portion of Beaver Creek still occupies the old valley, while an inverted stream now flows north in a directly opposite direction to that of the original Beaver Creek. The old valley across the divide to the Tohickon is seen as the gentle depression in the fields.

This explanation shows us why there is the sudden turn in the Tinicum just at this point. It has worked back on its easy course until it has captured Beaver Creek, and, as shown above, is continuing its work by pushing back towards the Tohickon, which it will very soon capture in the same way.

R. DeC. WARD.

Harvard College, Oct., 1891.

ASTRONOMICAL NOTES.

M. PALMIERI, director of the Vesuvian Observatory, is responsible for the statement that all the great eruptions of Vesuvius take place at new or full moon, and especially eclipses. The eclipse of June 17, 1890, was accompanied by violent earth currents. On the other hand, Captain de Montessus, who has patiently accumulated observations and data concerning earthquakes, has now a catalogue of more than 60,000 of these phenomena, individually discussed. He establishes that earthquakes are distributed uniformly throughout the day and night, that they have no relation to moon culminations and astronomical seasons, and that such coincidences which have been claimed in the past rest on insufficient ground.

M. Janssen, the eminent French astronomer, has been attempting to find solid rock on the top of Mount Blanc, upon which to build an observatory. His scheme has been to bore galleries through the ice, but so far he has been unsuccessful, and he is considering the feasibility of founding an observatory on the ice.

In the December number of *Knowledge* will be found reproductions of photographs, taken by Dr. Max Wolf of Heidelberg, of the region of the Milky Way in the constellation Cygnus, and also in the constellation Sagitarius. Mr. Ranyard, the editor of *Knowledge*, in an article entitled "Dark Structures in the Milky Way," calls attention to several interesting facts connected with the region of the heavens shown in the photographs. One of the regions covered is that surrounding Alpha Cygnus, and directly above that star is seen a dark, branching, tree-like structure. It evidently corresponds to a branching stream of matter which cuts out the light of the nebulous background on which it seems projected, and it is evidently intimately associated with the lines of stars which border the stream and its branches on either side. A somewhat similar dark branching stream may also be traced on a photograph of the region surrounding Epsilon Cygni, a copy of which appears in the October number of the journal above quoted. Altogether the article, with its attendant photographs, is very interesting, and brings to light some new facts connected with that region of the heavens in which the stars seem almost countless.

The small planet discovered by Dr. J. Palisa of Vienna, on Aug. 30 (now numbered 313), has been named Chaldea.

In a very interesting paper in No. 3,066 of the *Astronomische Nachrichten*, Professor Auwers gives the sun's parallax as 8.880″, with a probable error of ± 0.022″ This value is the result of the determination from the German Transit of Venus expeditions in 1874 and 1882, during which years 754 measurements were made. Professor Harkness, in his discussion of the results of the American Transit of Venus Commission, from the photographs alone; obtained the value 8.842″ for the sun's parallax, with a probable error of ± 0.011″. From a discussion of all the data obtainable, he obtained 8.80905″ ± 0.00567″. This latter value corresponds to a mean distance of 92,796,950 miles from the earth to the sun, while Professor Auwers's value corresponds to a distance of 91,814,000 miles.

The following is a continuation of the ephemeris of Winnecke's comet. The epoch is for Berlin midnight.

1892	R.A. h.	m.	s.	Dec. °	′
Jan. 12	12	28	12	+ 13	38
13		29	8	13	42
14		30	4	13	47
15		30	58	13	52
16		31	53	13	57
17		32	46	14	3
18		33	39	14	9
19		34	31	14	15
20		35	22	14	22
21	12	36	13	+ 14	28

The following is a continuation of the ephemeris of Wolf's comet. The epoch is for Berlin midnight.

1892	R.A. h.	m.	s.	Dec. °	′
Jan. 11	4	16	43	− 13	2
12		17	5	12	54
13		17	29	12	45
14		17	55	12	37
15		18	22	12	28
16		18	51	12	19
17		19	21	12	10
18		19	52	12	1
19		20	24	11	52
20		20	58	11	43
21	4	21	33	− 11	33

G. A. H.

THE GRADUATE STUDENTS' ASSOCIATION OF JOHNS HOPKINS.

THE *Johns Hopkins University Circular* for November gives the names of graduate students in that university from nearly every State in the Union. Nearly all the Canadian provinces and several foreign countries are represented. These three hundred students are here, primarily for hard work, each in his specialty, in one of fourteen departments. Not a few of the students enrolled last year are now studying in European universities, with the expectation of returning to their work here at the beginning of the next year.

There must be departmental isolation in every university, but this may become extreme. The best training for a capable and cultivated manhood can be obtained only as one mingles with his fellows and shares their varied experiences. An organization

which could furnish some tie of social solidarity between students while in residence here, and bring the men into easy communication with universities when abroad, has been lacking. This want, felt by the graduates and some members of the faculty, led to the formation, May 25, 1891, of the Graduate Students' Association. Similar associations have been formed in the universities of Edinburgh, Paris, and in other European universities.

The specific purposes of the association may be gathered from the resolutions passed at the first mass-meeting, from the constitution adopted Oct. 17, and from the reports of the various committees. All of these are freely used in the preparation of the present statement.

Any graduate student may become a member of the association on signing the constitution and paying a small annual fee

The honorary members consist of the members of the faculty, all past members of the association, and of such distinguished men at home or abroad as may be elected to honorary membership at the yearly meeting of the association.

The functions of the association are comprised in the divisions: international, national, and local or social. The committee on international relations furnish students going abroad with letters of introduction to similar associations in foreign universities, and receive students with letters from like associations of foreign universities. National functions are carried out by a committee who strive to promote intercourse with colleges and universities in the United States and present the advantages of this university to students who contemplate graduate work. This committee has charge of university extension in Baltimore. The social committee receive new students, acquaint them with university methods and give other desired information. They are the medium for co-operation between the faculty and students. They secure any advantages in trade, and adopt such means as may be feasible to promote sociability among the students.

These and other constitutional provisions have been carried out during the present half-year as follows: —

A students' committee, consisting of one from each department, elected by the graduate students of the several departments, was chosen.

The student representatives of the respective departments are: astronomy, Brantz M. Roszel; chemistry, J. E. Gilpin; geology, Francis P. King; biology, R. G. Harrison; physics, George O. Squier; mathematics, E. P. Manning; English, F. J. Mather; history, J. A. James; German, Albert B. Faust; Greek, John H. T. Main; Latin, Sidney G. Stacey; Sanskrit, William W. Baden; romance languages, Julius Blume; Semitic languages, J. D. Prince; pathology, S. Flexner. This general committee, in pursuance of powers granted, elected the association officers and appointed sub-committees for the present year.

The following officers and sub-committees were elected: honorary president, Professor H. B. Adams; president, John H. T. Main; vice-president, W. I. Hull; secretary, R. G. Harrison; treasurer, T. S. Baker; committee on international relations, J. E. Blume, David Kinley, and F. J. Mather; committee on national relations, J. A. James, G. W. Smith, and W. H. Kilpatrick; committee on social relations, R. P. Bigelow, A. B. Faust, S. G. Stacey, U. S. Grant, and J. Blume.

The work accomplished by the committees, although a mere beginning, serves to show that the association has a valuable place in university life. Communication has been entered into with associations of foreign universities. Lectures and courses of lectures have been given by graduate students in the interest of churches and of city associations.

Dr. Walter B. Scaife, a former Hopkins student, by the invitation of Professor Adams, is to give for the benefit of the association an illustrated lecture on "Florence and the Florentines." This lecture is to be given in Levering Hall and followed by an assembly in the parlors. This meeting will be the first of a series of social gatherings to take place during the year.

Through these means it is believed that departmental isolation will be overcome; that men may, through this association, enter into a broader student life, and that the university at large will be convinced of the need for wider social relations than are found in the laboratory or seminary.

JOHNS HOPKINS MARINE LABORATORY.

The following report of the 1891 session of the Marine Zoological Laboratory has just been made to the president of the Johns Hopkins University.

Early in May, 1891, some of the members of our party went to Jamaica, which had been selected as our field of work for the season, while others joined us later on.

Our party was as follows: W. K. Brooks, director; E. A. Andrews, associate in biology; R. P. Bigelow, graduate student in biology; J. P. Campbell, professor of biology, Athens, Georgia; G. W. Field, graduate student in biology; J. C. Gifford, special student in pathology; R. G. Harrison, H. M. Knower, and M. M. Metcalf, graduate students in biology; T. H. Morgan, Adam T. Bruce fellow; G. C. Price, graduate student in biology; John Stuart, teacher of science, Hope School, Jamaica; Charles Taylor, Kingston, Jamaica; B. W. Barton, lecturer in botany; Basil Sollers, teacher, Baltimore. The two last named devoted themselves to botanical exploration and study in the interior of the island, and they did not visit the laboratory at the seashore.

After a preliminary exploration of different seaports, we selected Port Henderson as our station. This is a seaside resort in Kingston Harbor, opposite Port Royal, and about nine miles by water from Kingston. Here we found two partially furnished houses suitable for a laboratory and lodgings, and we rented and occupied them for about fourteen weeks, from May 26 to Sept. 1.

The establishment of a party in a new home at a remote point in a strange country is a task which, in the mid-summer climate of the tropics, is most severe and exhausting. Of this, I was entirely relieved by Dr. Morgan and Mr. Bigelow, who themselves attended to all the preliminary work with great efficiency, and I take this opportunity to thank them for their willing help, which contributed in no small degree to the success of our expedition.

Our summer was devoted, in great part, to the collection and preservation of material for embryological work at home, and, as the members of the party are still employed in preparing and studying it, the results are not yet far enough advanced for reporting. There are a few noteworthy points of interest, however. Among them are the following: —

Soon after we settled at Port Henderson, Mr. Field found near our laboratory, in an enclosed lagoon of dense salt water, a very remarkable rhizostomatous medusa belonging to the genus Cassiopea. No special of this genus, as limited by Haeckel, has heretofore been found anywhere in the Atlantic. It is a South Pacific form, and the known species are from this region or from the Indian Ocean and the Red Sea. A species of a closely related genus, Polyclonia frondosa, was found by L. Agassiz on the coast of Florida, and was referred by him to the genus Cassiopea, although it is not a true Cassiopea. Polyclonia frondosa is found in Jamaica also, and we obtained specimens in Port Royal Harbor. It is also found in the Bahamas, and Professor H. V. Wilson has given to me the notes and drawings which he made from specimens which he obtained at Green Turtle Kay.

The medusa which we found at Port Henderson is not a Polyclonia, but a true Cassiopea, and the only one as yet found in the Atlantic. As it is very abundant and conspicuous, its escape from the notice of naturalists for such a long time is remarkable, for it is so well known to the negro fishermen of Jamaica that they have a name for it — the Guinea corn blubber. As it is one of the most common and characteristic marine animals of these waters, I have proposed to call it, after the Indian name of the island, Cassiopea Xamacha. While it is able to swim slowly by the pulsations of its bell, it is usually found fixed upon the smooth chalky bottom by the flat sucker-like surface of its exumbrella, and in some places the bottom was so completely covered with them that their circular discs were actually touching each other, while the interspaces were filled in by smaller specimens.

Our knowledge of the life history of the rhizostomatous medusæ is very incomplete, and is based entirely upon the study of the Mediterranean *Colytorhiza tuberculata*, a species which belongs to a more specialized division of the group than Cassiopea, although it was formerly called Cassiopea Borbonica. Many fundamental points in the development of the rhizostomes, and, in

fact, of the Discomedusæ in general, are still in dispute, and at my suggestion Mr. Bigelow undertook to trace the life history of our Cassiopea, a line of research for which the studies which he has pursued for nearly three years under my direction, on the structure of Discomedusæ, rendered him well qualified. He found the larvæ of Cassiopea on marine plants among the adults, and as these lived in captivity and set free peculiar planula-like buds, which also lived and grew in small aquaria in the house, he was able to obtain a fairly complete series of young stages. The most interesting results of his study of the living larvæ are the discovery of this peculiar method of budding, and the settlement of the question as to the origin and homology of the sense organs of adult Discomedusæ, which he has proved to be the modified basal portions of certain tentacles of the attached larvæ. This is supplementary to, and in amplification of, Mr. Bigelow's former work on the development of the sense organs in other groups of medusæ. While at Port Henderson he watched the larvæ undergo their metamorphosis, and he made drawings from life of the important stages. He is now completing his work by the study of serial sections of the larvæ, and of the organs of the adult. This work, which is now well under way, gives promise of results of very great interest, and I regard it as a very noteworthy piece of work, as it will be, when completed and published with ample illustrations, a permanent and valuable addition to our knowledge of the medusæ.

As I had hoped to find Chiton with eggs, Mr. Metcalf went to Jamaica prepared to study its development. We found several species of Chiton in great abundance on the rocks at Port Henderson, close to our laboratory. Within a few hours after his arrival he obtained the eggs, and soon had a series of larvæ, at all stages of development, living in the house in small aquaria. He devoted the season to the study of the living larvæ, and to the preservation of material for sections. He is now continuing the work at our laboratory in Baltimore, and he has constructed a series of enlarged models from his sections, to exhibit the process of segmentation of the egg of Chiton.

We found ourselves well placed at Port Henderson for studying the Termites, or so-called white ants, and Mr. Knower, who had at my suggestion prepared himself for this work before leaving Baltimore, spent his summer in observing their habits, and in collecting the eggs and larvæ, as well as the adults of the different castes. He preserved a fine collection of these specimens, for embryological and anatomical work, and he is now engaged in the prosecution of this portion of his research

Mr. Field continued at Port Henderson the study of the embryology of Echinoderms, upon which he has been engaged for two years past, and he added to his collection the eggs and larvæ of a number of forms of which he previously had no representation.

Mr. Morgan spent a great deal of his time in gathering and studying material bearing on the problem of metamerization in animals, and in this connection he collected the adults and embryos of Chiton, Ophiurans, etc. He also obtained at several places in the interior of the island a number of eggs from a species of tree frog, which has no tadpole stage, but hatches from the egg as a little frog. Some of these were kept in the laboratory in wet moss until they hatched, while others were preserved at successive embryonic stages. He was so fortunate as to obtain a very complete series of stages, and inasmuch as its development has never been studied, there is every reason to hope that most valuable results will be obtained by the thorough study of this material.

Some ten years ago I found at Beaufort an interesting Crustacean, Lucifer, whose metamorphosis is most remarkable and instructive. I obtained a few eggs, and reared the newly hatched larvæ, and traced the metamorphosis with exhaustive minuteness from the time of hatching to maturity; and my results, with ample illustrations, were presented to the Royal Society of London by Professor Huxley, and were published in the Philosophical Transactions. This work, which was among the first fruits of our marine laboratory, is now embodied in all the standard text-books.

I was not able, at Beaufort, to obtain enough eggs of Lucifer to study the embryology, although the few which I did find showed that this part of its life history is fully as important as the metamorphosis. I have been upon the watch ever since for a chance to obtain a supply of eggs, in order to supplement my first memoir on the metamorphosis by a second on the embryology; but while I have occasionally found Lucifer with eggs, out at sea, I have had no opportunity to study it, as the preparation of the material presents such difficulties that it cannot be carried on at sea. The adult animals are so small that they are almost invisible, and the eggs, which are microscopic, are so loosely attached and so delicate, that they are lost in the act of capturing the adults. I was greatly pleased to find Lucifer in abundance, and by going out in a boat and collecting the adults with great care, and taking them carefully home, I was so fortunate as to find some thirty or forty with eggs, and these I kept in aquaria long enough to obtain a tolerably complete series of stages in the embryonic development. I am now engaged in the study of this material, and I hope to have an account of the embryology of Lucifer completed within a year. My success in obtaining these eggs is an ample return for the expedition to Jamaica.

These are some of the subjects upon which we hope to contribute original scientific knowledge, as the result of our summer in Jamaica; but, be ides its value to science, the expedition had very great educational value to all of us. We saw for ourselves an endless variety of most interesting and instructive natural objects, which we had previously known only from books or preserved specimens, and every hour was filled with most delightful experiences of the greatest value to naturalists and teachers of natural science. I am sure that all the members of our party will be glad to join me in expressing our high appreciation of the great advantage which we have enjoyed in the opportunity to spend a summer in laboratory work at the seaside in Jamaica.

After our return to Baltimore, a series of public lectures, illustrated by specimens and photographs, was given by members of the party, under the auspices of the Naturalists' Field Club of the University.

The lectures were as follows: The Aspects of Nature in Jamaica, by W. K. Brooks; the Zoology of Jamaica, by E A. Andrews; the Natural History of Termites, by H. M Knower; the Botany of Jamaica, by B. W. Barton; and the People of Jamaica, by Basil Sollers.

W. K BROOKS.

AMONG THE PUBLISHERS.

THE "Browning Cyclopædia," which has been in preparation by Dr. Edward Berdoe, author of "Browning's Message to His Time," will be published very shortly by Macmillan & Co. It is probably the most generally useful of all the aids to the study of Browning as yet attempted.

— Ignatius Donnelly's new book will be entitled "The Cipher in the Plays and on the Tombstone." It is to place the truth of the belief in a cipher beyond controversy.

— Mrs. Laurence Gomme is engaged upon a book of children's games, and also upon a volume dealing with the various local feasten and ceremonial cakes, both of which subjects were rather prominent at the recent Folk-Lore Congress.

— T. Y. Crowell & Co. have just issued the fifth and concluding volume of Sybel's work on "The Founding of the German Empire by William I." The volume contains, besides the text, thirty pages of index and ten pages of chronological data.

— "Homilies of Science" is the title of a volume, by Dr. Paul Carus, from the Open Court Publishing Company, consisting of a collection of short editorial articles discussing religious, moral, and social questions from the standpoint of what might briefly be characterized as the religion of science.

— The office of *The Publishers' Weekly* will publish at once a useful hand-book for the bookseller and librarian, entitled "A Bookseller's Library, and How to Use It," by A. Growoll. The volume contains annotated lists of the principal American, English, German, and French book-trade catalogues, trade and literary journals, leading library and auction catalogues, catalogues of dealers in second-hand books with mention of their specialties, etc. These lists are accompanied by concise and practical hints as to how they may best be used, and the volume thus forms a desirable manual, particularly for the young bookseller.

— The *Atlantic Monthly* for January is a very good number. The article in it that is most likely to attract intelligent readers is that on "John Stuart Mill and the London and Westminster Review." Mill was the proprietor of that *Review* from 1836 to 1840, and had as his assistant in the editorship a young Scotchman named John Robertson; and this article consists in the main of letters that Mill addressed to Robertson during those years. The letters are very interesting, not only as revealing certain aspects of Mill's character, but also as showing the care with which he strove to keep the *Review* up to a high standard, and also with what keen intelligence he criticised the articles that were offered for insertion in it. Another article that is sure to attract notice is that on "Boston," by Ralph Waldo Emerson, in which the author traces the historical connection between the character of the early settlers and the moral and intellectual influence of Boston in American life. He justly says that Boston owes her influence to her religious earnestness and her instinct of freedom, and predicts that, so long as she retains these qualities, her influence will continue. This article was written in 1861, but has never before been published. Mr. Henry James contributes some reminiscences of James Russell Lowell, and expresses the opinion that Lowell's influence was mainly due to his style, both in writing and in speech, — a remark that is to a certain extent true, though the faults of Mr. James's own style are such that he is hardly a competent critic. Besides these papers, there are some excellent book-reviews, the beginning of a novel by F. Marion Crawford, and various other articles which we have not space to particularize. The *Atlantic's* programme for 1892 is unusually varied and promising; and the magazine is sure to have interested readers throughout the year.

— *Garden and Forest* for Christmas week contained, as its leading illustration, one of a grove of hemlocks whitened with lately-fallen snow, and in an editorial article the stateliness and grace of this northern evergreen are celebrated. There are pictures, too, of a rare orchid in bloom, and cultural directions for growers of fruit and flowers. Mrs. Robbins gives a sketch of Deering's Woods, Portland, in her New England Park series; Mr. Jack adds some notes on his horticultural tour through Europe, and M. Demontzey tells how he has tamed the torrents of the French Alps by reclothing their basins with growing forests.

— From the D. Van Nostrand Company we have received "How to Become an Engineer," by George W. Plympton (18°, 50 cents). It is a brief treatise on the theoretical and practical training necessary in fitting for the duties of the civil engineer, giving the opinions of eminent authorities on the subject, and indicating the courses of study in engineering usually followed in the technical schools. From the same company has come "The Sextant," by F. R. Brainard (18°, 50 cents), being a treatise on reflecting mathematical instruments, with practical hints, suggestions, and "wrinkles" on their errors, adjustments, and use. To the sextant, the form of reflecting instrument most commonly

used, most of the little volume is devoted. The volume is mainly a compilation of matter on the subject, well selected and judicially worked into shape; to which the author has added many ideas and suggestions of his own and of officers who have been associated with him in the naval service.

— The *Magazine of American History* opens its twenty-seventh volume with the New Year. The leading paper, by Hon. Arthur Harvey, the president of the Canadian Institute, is the first part of "A Critical and Common-sense View of the Enterprise of Christopher Columbus," illustrated. "The Secret Societies of Princeton University," by Thomas Hotchkiss, Jun., illustrates the old and new Whig Halls at Princeton. "A Short-lived American State," is a contribution from the Louisiana historian, Henry E. Chambers. The question, "Was America Discovered by the Chinese?" is discussed by Rev. Dr. Glover. Those who look for the editor's contribution will find it in an account of "Prince Henry the Navigator," the first to conceive the bold project of opening a road through the unexplored ocean, who indeed was the originator of the impulse which sent Columbus subsequently to our shores. "The Scot in America," by Hon. R. S. Robertson, turns the light upon a most interesting race among the founders of America. "A Sketch of John Badollett, 1758–1887," one of Indiana's strong characters in early times, is by President Bryan of Vincennes University. "Letters on Government Making, by Patrick Henry and John Adams, in 1776;" some things about "Collis P. Huntington," by Hubert Howe Bancroft; "Canada from a European Point of View in 1761;" and other short contributions complete the number.

— One of the early issues of D. C. Heath & Co. will be "White's Number Lessons," graded for second and third year pupils. It has been selected from the everyday blackboard work used in the Syracuse schools. It deals with numbers progressively from ten up into the thousands, using easy fractions and Arabic numerals throughout.

SCIENCE

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QUERY.

Can any reader of *Science* cite a case of lightning stroke in which the dissipation of a small conductor (one-sixteenth of an inch in diameter, say,) has failed to protect between two horizontal planes passing through its upper and lower ends respectively? Plenty of cases have been found which show that when the conductor is dissipated the building is not injured to the extent explained (for many of these see volumes of Philosophical Transactions at the time when lightning was attracting the attention of the Royal Society), but not an exception is yet known, although this query has been published far and wide among electricians.

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N. D. C. HODGES,
874 BROADWAY, NEW YORK.

SCIENCE

NEW YORK, JANUARY 8, 1892.

INFANTS' MOVEMENTS.

In an earlier article,[1] I had occasion to speak of certain phenomena of the infant's muscular development — the phenomena which illustrate the principle of suggestion. A brief survey of certain general characters of these early movements may now be made.

From the outset, movement is the infant's natural response to all influences. And, more than this, Bain and Preyer seem to have made out their case, that from the outset there are movements which are spontaneous, due to unsolicited discharge of the motor centres. At any rate, no observation made after birth can decide the question one way or the other. It remains for the embryologists to continue their work, and this is where Preyer's results get their principal value.

In regard to movements more properly reflex and responsive, I may record a few detached observations on my child. Carefully planned experiments with her, made in the ninth month, showed the native, walking reflex — alternative movement of the legs — very strongly marked. I held her by the body, having made the legs quite free, in a position which allowed the bare feet to rest lightly upon a smooth table. The reflex seemed to come somewhat suddenly, for up to the middle of the eighth month I could not discover more than a single alternation; and this I had determined not to take as evidence, since it could well arise by chance. But, in the ninth month, I observed as many as three and four well regulated alternations in succession. At first most of these movements were the reverse of the natural walking movements, being oftenest such as would carry the child backward. This, however, passed away. I have the following note on June 13, 1890 (the child being one day short of nine months old): "Walking movements, 3 to 4 alternations, backwards oftenest, but tending rapidly to forward movements; later, 2 experiments, each showing 3 to 4 alternations forwards very plainly;" and on June 19: "Fine activity in walking — good alternations, but more backwards than forwards — clearly reflex, from stimulus to the soles." It is easy to see that this backward alternation might be due to some accident of stimulation or discharge when the reflex was first called out; a tendency which early efforts at creeping would soon correct. Yet in H.'s case, it was so marked that for a period she preferred to creep backward.

A few observations were made also upon bilateral reflexes. A gentle touch with finger or feather on the cheek, or beside the nose, or upon the ear, when H. was sleeping quietly upon her back, called out always the hand on the same side. After two or three such irritations, her sleep became troubled and she turned upon the bed, or used both hands to rub the place stimulated. Tickling of the sole of the foot also, besides causing a reaction in the same foot, tended to bring about a movement of the hand on the same side. These observations, not a large number, were made in the sixth, seventh, and eighth months.

A reference has already been made to the late rise of real phenomena of imitation. In support of the assertion, that imitation is rather late in its rise, the following experiences may be reported. As a necessary caution, the rule was made that no single performance should be considered real imitation unless it could be brought out again under similar circumstances. It is probable that cases of imitation recorded as happening as early as the third month are merely coincidences. For example, I recorded an apparent imitation by H., of closing the hand, on May 22 (beginning of the ninth month), but on the following day I wrote, "experiment not confirmed with repeated trials running through four succeeding days." H.'s first clear imitation was (May 24) in knocking a bunch of keys against a vase, as she saw me do it, in order to produce the bell like sound. This she repeated again and again, and imitated it a second time a week later when, from lapse of time, she had forgotten how to use the keys herself. But on the same day (May 24), other efforts to bring out imitation failed signally, i.e., more or less articulate sounds, movements of the lips (Preyer's experiments), and opening and closing of the hands. Ten days later, however, she imitated closing the hand on three different occasions. And yet a week afterward, she imitated movements of the lips and certain sounds, as *pa*, *ma*, etc.[1] From this time forward the phenomenon seemed extended to a very wide range of activities, and began to assume the immense importance which it always comes to have in the life of the young child. It may be noted that H.'s first clear imitation plainly involved a complex voluntary muscular performance; and as far as a single instance is of value, it shows that the will may get control of certain muscular combinations before they are called out to a great extent involuntarily. In this respect, also, my observations confirm Egger's.[2]

In order to test the growth of voluntary control over the muscles of the hand and fingers, I determined to observe the phenomena of H.'s attempts at drawing and writing, for which she showed great fondness as soon as imitation was well fixed. Selecting a few objects well differentiated in outline — animals which she had already learned to recognize and name after a fashion — I drew them one by one on paper and let her imitate the "copy." The results I have in a series of "drawings" of hers, extending from the 7th of last April (the last week of her nineteenth month) to the present (middle of the twenty-seventh month). The results show that, with this child, up to the beginning of the twenty-seventh month there was no connection apparent between a mental picture in consciousness and the movements made by

[1] Science, xvii., 1891, p. 112.

[1] Egger notices this late development of vocal imitation, "L'Intelligence et Langage chez les Enfants," p. 18.

[2] Loc. cit., p. 18-20. Yet I cannot hold with Egger that imitation always involves "intelligence."

the hand and fingers in attempting to draw it. The "drawing" was simply the vaguest and most general imitation of the teacher's movements, not the tracing of a mental picture. And the attempt was no better when a "copy" was made by myself on the paper—a rough outline drawing of a man, etc. There was no semblance of conformity between the child's drawing and the copy. Farther, while she could identify the copy and name the animal, she could not identify her own effort, except so far as she remembered what object she set out to make.

But in the next week (early in the twenty-seventh month) a change came. I drew a rough human figure, naming the parts in succession as they were made: she suddenly seemed to catch the idea of tracing each part, and she now for the first time began to make figures with vertical and horizontal proportion; i.e., she followed the order she saw me take: head (circle), body (ellipse) below, legs (two straight lines) further below, hands (two lines) at the sides of the body. It is all done in the crudest fashion, but that is due to the lack of muscular co-ordination. With the simplification of the figure by breaking it up into parts came also the idea of *tracery imitation*, and its imperfect execution.

As yet, however, it is limited to two or three copies — objects which she sees me make. That it is not now simply imitation of my movements is evident from the fact that she does not imitate my movements: she looks intently upon the figure which I make, not at my movements, and then strives to imitate the figure with movements of her own very different from mine. But she has not generalized the idea away from particular figures, for she can not trace at all an altogether new figure in right lines. Further, she traces these particular figures just as well without written copies before her: *here, therefore, is the rise of the tracery imitation of her own mental picture* — a fact of great theoretical interest.

This illustrates again the point so strangely overlooked by writers on the rise of volition that the earliest voluntary acts are not voluntary movements. The thing pictured and willed here is not a movement, it is a figure — man, bird, dog. This figure suggests (stimulates) its motor associates. It is only later that the muscular movement becomes conscious end.

In the nature of the movements which the child has made in this series of drawings there is a marked change and development. There is growth from angular straight lines to curves, from movements one way exclusively to reverse movements, and an increasing tendency to complex intricate figures, which last probably results from greatly increased ease, variety, and rapidity of movement. At first she made only sweeping "arm-movements," then began to flex the wrist somewhat, and now, with no teaching, she manipulates the pencil with her fingers considerably. This seems to give support to the opinion of professional writing-teachers that the "arm-movement" is most natural and effective for purposes of penmanship.

Further, all her curves are made by movements from left to right going upward and from right to left downward. This is the method of our usual writing as contrasted with "backhand." She also prefers lateral to vertical movements on the paper. Her most frequent and easy "drawing" consists of a series of rapid right-and-left strokes almost parallel to one another.

J. Mark Baldwin.

A FEW CHARACTERISTICS OF THE AVIAN BRAIN.[1]

When we compare the brain of a crow or a titmouse with the brain of a snake or a turtle, it is no longer a marvel that birds bear towards their reptilian cousins the relation of intellectual giants to intellectual dwarfs. The cranium of reptiles is small, while the brain-cavity of birds is large, and, what is more pertinent, the whole of that cavity is filled with a compact brain mass. Not only that, but the cerebrum, the seat of the intellectual faculties, constitutes the major portion of that mass.

The cerebrum is composed of two lateral halves or hemispheres, which are so situated that they form a compact heart-shaped mass. The apex of this heart is directed towards the bill of the bird, while the notch is directed towards the tail. These hemispheres are unconvoluted, but the borders of some of the superficial lobes approach almost to the dignity of convolutions. Furthermore, a microscopic study of the brain reveals the fact that occasionally there occurs a blind convolution; i.e., an internal projection of gray matter without a concomitant surface convolution.

A microscopic study of the bird brain does not reveal a cerebral cortex similar to that of the human cerebrum. Here the cerebral cortex is represented by a thin hull containing several loosely aggregated cell-clusters. These cell clusters are constant and are homologous to corresponding clusters in the lizard brain.

Next in size to the cerebrum comes the cerebellum. Not only is it transversely convoluted, not only is it a cover for the medulla, but it is also partly wedged into the notch between the two halves of the cerebrum. This high development of the cerebellum of birds, coupled with the corresponding high development of the cerebellum of fishes, is a strong argument in favor of the hypothesis that the cerebellum functions as a co-ordinating centre for muscular movements.

Neurologically considered, birds are pre-eminently seeing animals, and all parts that appertain to vision are highly developed. The optic nerve is the largest cranial nerve, and the optic lobes are completely differentiated bodies. Even the third, fourth, and sixth cranial nerves, although quite small, are relatively larger than the corresponding nerves of the mammalian brain.

An extraordinary development of one set of organs is never accomplished but at the expense of some other set. In this case the organs of the sense of smell have been the martyrs. Although in the lower avian types the olfactory lobes are paired and conspicuous, yet in the highest types of birds they have been reduced to a small unpaired body which is partly imbedded in the base of the cerebrum.

These two facts lend support to the view that birds of prey find their food more by aid of the sense of sight than by aid of the sense of smell. The birds of prey are far from the lower end of the scale, and in all cases examined the olfactory lobes have been relatively smaller than the corresponding lobes of chickens, geese, turkeys, etc. I have not yet examined a buzzard's brain; but, judging by the figures of A. Bumm,[2] they have small, inconspicuous olfactory lobes.

From the above statements, we see that economy of space is evidenced in all parts of the avian brain. Indeed "progressive compactness" has played so important a part in the evolution of birds that there is a vast difference between the

[1] This is but a brief abstract of a portion of my paper upon the "Morphology of the Avian Brain," Journal of Comparative Neurology, vol. I., pp. 59-95, 107-134, 265-286, pl. V.-VIII., XIV.-XVI., XVIII.

[2] Das Grosshirn der Vögel, Zeitschrift f. Wiss. Zoologie, Bd. xxxviii., 1883.

lowest avian brains, with their large projecting olfactory lobes and uncovered optic lobes, and the highest avian brains, with their small, inconspicuous olfactory lobes and covered optic lobes. The difference between these two extremes is almost as great as that between the brain of a lizard and the brain of the lowest type of birds. Yet there is no impassable gulf between these two extremes. All the intervening stages are supplied by the brains of the various avian groups. In reviewing this remarkable sequence, we are almost forced to believe that this tendency towards a progressive compactness of the brain existed long before the first bird was evolved. If this be true, then this tendency towards a progressive compactness of the brain, combined with a tendency to develop all parts appertaining to vision and to atrophy all parts appertaining to smell, will account for all the major differences between the avian and the reptilian brain.

Furthermore, within this class of animals, this "progressive compactness" of the brain is a factor of taxonomic importance. So far at least as major groups are concerned, a classification based upon it alone is, for the most part, in harmony with those classifications that are based upon other structural elements of birds.

Histologically considered, the bird brain is composed of nerve fibres, nerve cells, and neuroglia. Excepting the fornix and hippocampal commissures, all the principal commissures of the mammalian brain, corpus callosum included, are found in the avian brain. Poverty of space causes the omission, in this abstract, of the various other tracts of the bird brain.

Although in the bird brain the nerve cells present a great diversity of forms, yet they may all be grouped in the following classes: ganglionic cells, Deiter's corpuscles, fusiform or flask cells, pyramidal cells, and multipolar cells. The ganglionic cells are large bi-polar cells, which are never found outside of the root ganglia. Each extremity of the cell is prolonged into a nerve fibre. One fibre passes into the brain, the other into a nerve. In addition to the ordinary cell wall, each of these ganglionic cells is surrounded by a special nuclei-bearing sheath. Deiter's corpuscles are small cells, which are supplied with so small an amount of protoplasm that ordinary preparation reveals nothing but their nuclei. These minute cells are universally distributed. In the cerebellum, however, they are densely aggregated in a single lamina; while in the optic lobes they are densely aggregated in several concentric laminæ. The remaining three types are encountered throughout the brain; but in any single nidulus some type always predominates, often to the exclusion of the other two. The flask cells resemble a flask in shape, and when stained each cell presents a faintly stained nucleus, within which is a densely stained nucleolus. Such cells are supposed to function as sensory cells. The pyramidal cells are sub-pyramidal in outline. These cells stain densely, when each one presents a densely stained nucleus, within which is a densely stained nucleolus. Such cells are probably motor in function. The multipolar cells resemble distorted, many-branched, pyramidal cells. Such cells probably act as switch stations for nervous energy.

University of Cincinnati, Dec. 31, 1891. C. H. TURNER.

A NEW SABRE-TOOTHED TIGER FROM THE LOUP FORK TERTIARY OF KANSAS.

In a collection of Loup Fork Tertiary fossils obtained by the writer from northern Kansas, is a right upper canine of *Machærodus*, apparently different from that of any of the known species of that genus.

The remains of several feline animals have been described from the Loup Fork, one of them (*Felis maxima*, Scott) being the largest of all known *Felidæ;* but none referred to the genus *Machærodus* has been announced. It may, however, yet appear that the *F. maxima* itself, which Professor Scott has but provisionally referred to the genus *Felis*, is a machærodont.

The Loup Fork canine includes the entire root and neck and the basal portion of the crown. As nearly as it is possible to judge, it represents an animal about as large as the puma, but it must be borne in mind that the size of an animal cannot be very positively and closely estimated from a part so highly specialized and so subject to variation in the ratio of its size to that of the body as is the canine in this genus. In any event, the tooth indicates an animal smaller than any of the known American Pleistocene species, unless it be *M. gracilis*, Cope, and considerably larger than the European Miocene *M. palmidens*, de Blainville.

As compared with the larger American species of *Machærodus* (*M. necator*, etc.), *M. gracilis* is characterized by the more compressed form of the basal portion of the upper canine; and this compression is said to be a marked feature. In the Loup Fork species, on the contrary, that tooth has greater relative thickness than in *M. necator*, the thickness of the tooth, at base of crown, being related to its breadth as 1 to 1.65, while the corresponding ratio in *M. necator* (taken from Cope's illustrations) is 1 to 2.2. In *M. neogæus* the ratio, derived from the measurements given by Burmeister, is 1 to 2.33.

The Loup Fork species may be known as *Machærodus crassidens*.

The canine of *M. crassidens* presents a gentle curvature and has its posterior cutting edge compressed and denticulated. Whether the anterior border was of similar character is uncertain. The form of a point-like downward prolongation of the surface of fracture on the anterior border of the crown may have been determined, when the tooth was broken, by the presence of a compressed border, but, if so, the contour of the preserved part of the crown does not indicate it. It is, at least, certain that a denticulate carina did not extend so far from the apex on the anterior as on the posterior border.

DIMENSIONS.

	Inches.
Breadth of crown of canine at base	1.14
Thickness of same	.69
Breadth of crown 1.5 inches above base (about)	.83
Thickness of crown at same (about)	.46
Length of root of canine (to origin of denticulated keel)	2.44
Length of canine, as restored (approximate)	5.45

Should new material prove that only the posterior margin of the canine is denticulated, the species would, in this respect, resemble the *Machærodus nestianus* of the upper Pliocene of Italy.

F. W. CRAGIN.
Colorado Springs, Col.

NOTES AND NEWS.

THE Pennsylvania State Board of Health, at the instance of the Governor of Pennsylvania, has issued an invitation to the other State and the more important city boards of health, and to the American Public Health Association, to join in a conference with the officers of the World's Columbian Exposition at the city of Chicago, with the view to making an exhibit of the objects, methods, and results of the work of sanitary officials in this country.

— Mr. Charles S. Peirce has tendered his resignation as Assistant in the United States Coast and Geodetic Survey, to take effect Dec. 31. Mr. Peirce was first attached to the Survery about thirty

years ago. During the greater part of the time he has had charge of its operations relating to the determination of the force of gravity. Some of the results of his investigations have been published as appendices to the Annual Reports and have embodied contributions of great importance to science. It is understood that Mr. Peirce will continue to furnish the Survey from time to time special discussions of topics related to the subject to which he has devoted so many years.

— The routes, both northern and southern, now formally adopted by the principal transatlantic steamship companies are shown on this month's Pilot Chart issued by the United States Hydrographic Office. The northern routes remain in force until the middle of January, but steamers that take their departures from Sandy Hook Light-vessel, Boston Outer Light, Fastnet, or Bishop's Rock, on or after the 15th, follow the southern routes, which then remain in force till the middle of July next. As stated last month, on the chart, five steamship companies (the Cunard, White Star, Inman, Guion, and National) have adopted these routes to and from the Fastnet, and the following companies have now come into the agreement (taking the great circle between Bishop's Rock and the Banks): North German Lloyd, Hamburg-American, Companie Générale Transatlantique, and Red Star. It will be remembered that the Pilot Chart recommended that the Channel steamers adopt the same routes (west of the 20th meridian) as the Queenstown steamers, but these companies have decided to follow the great circle direct to the Grand Banks. The objection to this course is that the region within which eastward and westward bound vessels are liable to encounter one another is broader than in case the point of junction is shifted farther east, say to the 20th meridian, while the distance saved is comparatively slight (only six miles for the northern and nine miles for the southern routes). Possibly at some future time a compromise will be made by which the junction will be fixed at some point that may be mutually agreed upon (say about the 15th meridian in latitude 51° north). Until such an arrangement is made by the companies interested, the routes already adopted and actually in force will be shown on this Chart.

— A correspondent of the London *Spectator*, writes os follows: I have studied the habits of the scorpion for many years, and have often noticed how very sensitive scorpions are to the most delicate sound, musical or otherwise. Under the thorax the scorpion has two comb-like appendages, which are the antennæ (pectinatæ). It is pretty well settled by physiologists and entomologists that in insects the antennæ represent the organs of hearing. These delicate structures are easily affected by the vibrations of sound, and there can be no doubt whatever that they are also affected by sounds quite inaudible to the human ear. The slightest vibration of the atmosphere, from any cause whatever, at once puts in motion the delicate structures which compose the antennæ, to which organs insects owe the power of protecting themselves against danger, as well as the means of recognizing the approach of one another. Spiders have wonderful eyesight, but I am quite sure that the scorpion's vision, notwithstanding his six eyes, is far from being acute. It is very difficult to catch a spider with a pair of forceps, but a scorpion can be easily captured, if no noise is made. Spiders see their prey before they are caught in the web; but the scorpion makes no movement whatever to seize flies or cockroaches until they indicate their whereabouts by movements. This being the case, it can readily be understood how easily the scorpion may be roused into motion by the vibrations of music, as described in the article alluded to. If a tuning-fork be sounded on the table on which I keep my caged scorpion, he at once becomes agitated, and strikes out viciously with his sting. On touching him with the vibrating tuning-fork, he stings it, and then coils himself up, as scorpions do when bedged in. In Jamaica, the negroes believe that scorpions know their name; so they never call out, "See, a scorpion," when they meet with one on the ground or wall, for fear of his escaping. They thus indirectly recognize the scorpion's delicate appreciation of sound; but if you wish to stop a scorpion in his flight, blow air on him from the mouth, and he at once coils himself up. I have repeatedly done this; but with a spider it has a contrary effect. Music charms a snake into silence, as the experiments at the Zoo and elsewhere prove; but the agitated contortions and writhings of the scorpions when roused by the sound of the violin only prove that they are roused by the vibrations of sound caused by music, and this would happen if they were disturbed by the discordant sounds of a penny trumpet or any other unmusical instrument.

— At the recent French Surgical Congress MM. Henocque and Bazy reported the results of a series of examinations of the blood with the spectroscope made on persons who were compelled to undergo surgical operations. According to these investigations the demonstration of the quantity of hæmoglobin in the blood affords the surgeon some valuable information in cases where it is necessary to decide whether the patient's health is sufficiently good to permit of the performance of an operation which may not be urgently required. In ovariotomies and laparotomies undertaken for the removal of tumors it is of advantage to determine the degree of anæmia and the condition of nutrition by this method, so that the operator may be able to select the most favorable time for operation. The authors also made, according to the *International Journal of Surgery*, some exceedingly interesting experiments with the view of studying the effects of chloroform anæthesia upon the quantity of oxy-hæmoglobin in the blood and upon tissue metamorphosis. These investigations were carried on before, during, and after the performance of surgical operations. It was demonstrated in eight cases of major operations that chloroform actually tends to augment the quantity of hæmoglobin in the blood, unless a condition of asphyxia is produced, and that this quantity may remain stationary despite severe losses of blood. One of the constant effects of chloroform anæsthesia, however, is to retard the reduction of oxy-hæmoglobin; that is to say, it decreases tissue metamorphosis. These phenomena therefore illustrate that chloroform does not exert a toxic influence on the blood, although it has a marked effect in retarding the vital chemical processes in the body. In cases of sudden death at the commencement of chloroform anæsthesia a complete arrest of tissue metamorphosis takes place, and to this, in the authors' opinions, should be attributed the extraordinary severity of this form of syncope. They also believe that these facts demonstrate the advantage of determining before operation whether an individual tendency to retarded tissue metamorphosis be present. In striking contrast to the results obtained by MM. Bazy and Henocque, however, Dr. Mikulicz found that the prolonged administration of chloroform produced a decrease of hæmoglobin even in operations unattended with loss of blood. This fact simply illustrates the wide discrepancy in the results obtained by different investigators of the same subject.

— In a bulletin just published by the Entomological Division of the Cornell University Experiment Station, Professors J. H. Comstock and M. V. Singerland report upon a series of experiments, continued for three years, the object of which was to discover a practical method of preventing the ravages of wireworms. Some of the results of these experiments are summarized as follows: Grains of corn were coated with a flour paste containing Paris green and planted. The only apparent result was to retard the sprouting of the seeds, the wireworms apparently thriving upon the poisoned paste. The rose bug is another insect which it is practically impossible to kill with Paris green. Coating the seed corn with tar or soaking in salt brine, copperas solution, kerosene oil, or turpentine interfered with germination much more than it did with the appetite of the wireworm. Soaking in strong solution of strychnine failed to render the corn either distasteful or destructive to the worms. Starvation was found to be as ineffectual as feeding on poison, as the soil was kept entirely bare of vegetation for an entire season without reducing the number of worms. Buckwheat, Chinese mustard and rape have been recommended as crops upon which wireworms will not feed, but in these experiments the worms lived and thrived as well upon the roots of these plants as they did upon those of timothy and clover. Kerosene oil, crude petroleum and bisulphide of carbon were applied to the soil as insecticides, the kerosene and petroleum being also used in the form of emulsions. They killed the wireworms when applied in sufficient quantity to destroy all vegetation also.

Their use was found impracticable on account of the cost. Many farmers believe that salt either kills wireworms or drives them deeper into the soil beyond the roots of crops, and a series of carefully planned experiments were made to test this theory. The results showed that in order to destroy wireworms salt must be used at the rate of about eight tons to the acre, or over one per cent of the soil to a depth of four inches must be salt. Half a ton of salt to the acre was found sufficient to prevent one-half the wheat from germinating, and four tons per acre, applied in July, killed all the grass in a few days. In soil salted at the rate of 1,000 pounds per acre the worms were found, after some months, as numerous and as near the surface as in unsalted soil. Kainit, a German potash salt now used extensively as a feltilizer, has been supposed to be useful in exterminating wireworms, and the syndicate which is pushing the sale of Kainit in this country make great claims on this score; but in the Cornell experiments four to nine tons of Kainit per acre produced but little if any effect upon the wireworms in the soil. Other potash salts gave no better results. Lime, applied at the rate of 200 bushels per acre, had no effect upon the wireworms. Chloride of lime, used at the rate of nearly six tons per acre (costing about one hundred dollars per ton), was found to be quite effective. Gas lime, applied fresh and at the rate of twenty to forty tons per acre, proved partially effective. Trapping by baits produced the only results that gave any encouragement, but these baits caught, not the wireworms, but its parent, the click-beetle. The most satisfactory trap was a wad of fresh clover, dipped in Paris green water and placed under a board. These experiments were made in cages in such manner that the conditions could be absolutely controlled and the results accurately determined. Their negative results may be of great value to farmers by preventing the waste of time and money in trying useless methods of prevention. The only hope of a practicable remedy the investigators hold out to the farmers is that by fall plowing the worms may be disturbed at a critical period of their existence, when disturbance means death. They recommend plowing as soon as possible after wheat harvest, pulverizing immediately and thoroughly with the harrow, and seeding with wheat or rye in September, followed by not more than one or two crops of grass or clover, this to be plowed under in the summer as before. It will take several years of this method of short rotations to exterminate the worms, as they live for three years in the worm stage, and can only be injured by plowing at a certain period, but farmers who practise this method have little or no trouble from wireworms.

— At the recent annual meeting of the American Folk-Lore Society, in Washington, D. C., Rev. J. Owen Dorsey read a paper, entitled, "Nanibozhu in Siouan Mythology." At the previous annual meeting of the Society (in New York), a paper was read by Professor A. F. Chamberlain of Clark University, on "Nanibozhu among the Otchipwe, Mississagas, and other Algonkian Tribes." (*Journal American Folk-Lore*, for July–September, 1891, pp. 193–218). Mr. Dorsey's paper was designed to show the points of agreement and difference (so far as Nanibozhu is concerned) in the mythologies of the two linguistic stocks of families, the Algonkian and the Siouan. In the preparation of Mr. Dorsey's paper, the author consulted the myths of the Omahas, Ponkas, Kansas or Kaws, Osages, Iowas and Otos, all of which were collected by himself for the Bureau of Ethnology, and the Dakota myths of the late missionary, S. R. Riggs, and those in the Bushotter collection, these last consisting of two hundred and fifty-seven texts written by an Indian in the Teton dialect of the Dakota language. In Algonkian mythology, Nanibozhu, Manabush, or the Great Hare (sometimes called the Manito of winter), is a single character, easily identifiable. But in Siouan mythology we find several characters, each one of whom resembles the Algonkian Nanibozhu in one or more respects. The principal characters thus known to the Omahas and Ponkas are the following: 1. The Rabbit, the great friend of the Indian race (answering to the Badger in Dakota mythology). 2. I-shti-ni-ke, the enemy of the Rabbit, the great Deceiver, a malevolent being. His Dakota counterpart, I-kto or I kto-mi in Teton, and Un-kto mi in Santee Dakota, is often a clown, a "jolly good fellow" deceived by the Rabbit, malevolent on some occasions. The Omahas call I-shti-ni-ke the "Black Man," and they and the Ponkas now apply his name to any species of ape or monkey. The Dakotas give the name of Ikto or Unktomi to the spider. 3. Ha-ghi-ge, a very cunning person, who wounds two water gods in order to avenge the death of his little brother, meets I-shti-ni-ke, when the latter is disguised as He-ga, the Buzzard, learns his secret power, and then kills him; kills the water gods whom he had wounded; is chased by the other deities, but escapes by becoming a large rock; restores his brother to life for a season; and has other adventures. The other characters who resemble Nanibozhu are as follows: In Dakota myths, the Badger figures instead of the Rabbit, and the Blood-Clots Boy takes the place of the Rabbit's son, the orphan and Wears-a-plume-in-his-hair. In the myths of the Omahas it is the orphan who kills I-shti-ni-ke, but the Ponkas refer that act to the Rabbit's son. Wears a-plume in-his-hair was the conqueror of the "Bad Men," magicians, three of whom he killed; he sought the survivor, but did not recognize him in his disguise as a beautiful woman. The woman induced the hero to rest his head in her lap, and while he slept she changed him into a mangy dog, and took the hero's shape. In the course of time, the hero was restored to his own shape. He changed the bad man into a dog, and then killed him. The Omaha and Ponka myths referred to in this paper are given in full in their respective originals (with free and interlinear translations) in "Contributions to N. A. Ethnology," Vol. 6, which has just been published. The paper on Nanibozhu will probably appear in a future number of the *Journal of American Folk-Lore*.

— In a recent number of *The Illustrated American* is an illustrated article on the Museum of Natural History at South Kensington, which was first thrown open to the public on Easter Monday, 1881. Some years ago the British Museum had become so overstocked in certain departments that it was deemed necessary to erect another structure, to contain all objects connected with natural history, and Parliament voted three hundred and ninety-five thousand pounds (nearly two million dollars) for the purpose. Alfred Waterhouse was the architect chosen to carry out the work. The architecture may be termed Decorated Norman, and in some respects it is unique. The whole edifice is cased with terra cotta, and the doorways and windows are ornamented with columns designed from objects of natural history—two features that have provoked much criticism. It has been charged, says *The Illustrated American*, that the tint of the terra cotta is not suitable for making the various articles in the museum stand out in relief; that it was a mistake to bring in close proximity the real objects of natural history and the conventional representation of them adopted by architects; and that the crowding together on the same column or moulding representations on one scale, of microscopic and gigantic organisms, inhabitants of sea and land, was unwarrantable in a building designed for educational purposes. Complaint has also been made that the great hall is semi-ecclesiastical in style. The south front of the building is six hundred and seventy-five feet long. There are three stories, in addition to the basement. The central hall is one hundred and fifty feet long, ninety-five feet wide and sixty feet high. Along its two sides are twelve arched recesses. The floor is inlaid with mosaics of Italian marble. At the north end of the hall is a wide handsome staircase, which branches off, right and left, to the open corridors or side aisles on either hand upon the first floor. Where the stairs branch a superb marble statue of Darwin has been placed. The lofty ceiling is admirably decorated, and is very effective. Along its central line there is a double row of panels, in groups of six, following the curve of the vault. On these are representations, in relief, of many species of trees, shrubs and flowering plants. Each tree decorating the central part of the ceiling occupies six panels. The height of the building makes this bold treatment absolutely necessary. But over the staircase and landing leading to the second floor the ceiling is less distant from the eye; therefore a tree is represented in each panel, and many fine details have been carefully worked out, details that were purposely omitted in the central part, as they would have been lost in the distance. One unpleasing effect of the loftiness of the arched roof is that it dwarfs the cases placed around the room.

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THE KLAMATH NATION.[1]

II.—Linguistics.

When, early in the present century, the American languages, or rather a certain number of them, and particularly those of the Algonkian, Iroquoian, Mexican, Peruvian, and Araucanian families, became the subjects of scientific study, the first emotions which this study excited were those of surprise and pleasure. The elaborate forms, the many ingenious methods of word-composition, and the singular capacity for expression thence derived, filled the first inquirers with admiration. This admiration, expressed with the enthusiasm of discoverers, naturally awakened scepticism and adverse criticism. The criticism, originating mainly in prejudice and the pride of race, and based on that partial knowledge which is sometimes more misleading than ignorance, was for the most part unfounded and unjust. The critics objected that the American languages, being those of barbarous tribes, must necessarily be inferior to the idioms of highly civilized races, like the Aryan and Semitic nations; but they forgot that the early Aryans and Semites were themselves barbarians, and yet their languages, as we know from many facts, were as well constructed and as expressive in their era of barbarism as in that of their highest culture. The objectors also informed us that the reason why the words of the American languages were of such elaborate formation and often excessive length, was simply because the speakers, being barbarians, had not attained the analyzing power required to reduce the vocables to their component parts; but further investigations have shown that many American languages, including the Dakota, the Maya, and the Othomi tongues, are in some respects even more analytic than the Aryan, and their words generally briefer. We were further told that the American idioms had not the substantive verb, which, we were assured, was the highest expression of Aryan and Semitic analysis and abstraction. But later researches have found this verb in the Athapascan, the Sahaptin, the Klamath, and various other Indian tongues, as fully developed as in the Sanscrit or the Greek. Then we were assured that American languages had few or no expressions for abstract ideas. We now find that some of them abound in such expressions, and have peculiar forms especially designed to indicate them. The objectors derided certain Indian languages, like the Iroquoian and the Algonkian, in which the terms of kindred must always have a possessive pronoun attached to them. How poor, they argued, must be the speech of a people who cannot say simply "father" and "son," but must always employ the composite forms, "my father," "his son," and the like. We now know that languages of this type are not universal, and that in idioms spoken by tribes lower in culture than the Algonkians and the Iroquois, the possessive pronouns are independent words, and are never attached to the nouns. Finally, these critics, all of Aryan or Semitic origin, proudly assure us that the noble races to which they belong are the only peoples whose languages are really inflected. All other idioms belong to a lower type, the "agglutinative." Their so called inflections are simply bits of significant words, affixed to the roots, and still retaining indications of their origin. Duponceau, the first and greatest of American philologists, has long ago shown, by the evidence of the Delaware grammar, the error of this assumption; and we now have to see how completely this and most of the other objections of the worshippers of the Aryo-Semitic fetish are disproved by the results of Mr. Gatschet's careful and thorough studies.

Pure inflection, properly speaking, — that is, inflection of non-agglutinative origin, — is a change made in the substantial or radical part of a word to indicate a difference of meaning, as when the Hebrew changes the ground form of *lamar*, to learn (or "he learned"), to *lemor*, to express the imperative mood, or as when the Ojibway, to form the participle, changes *nimi*, he dances, to *namid*, dancing. In the primitive Aryan languages the most important change of this description is the reduplicative form, which in the Sanscrit, Greek, and Gothic, and occasionally in the Latin and other tongues, is used to give a preterite signification. This form of inflection occurs, with varying purport, in many American and Oceanic languages. Most generally it indicates plurality, as in the Mexican and Sahaptin idioms; but frequently it expresses (as in the Japanese and the Dakota) iteration, distribution, or other allied meanings. In the Klamath it assumes a wide development, pervading the whole language, and modifying almost all the parts of speech, from nouns and verbs even to many of the particles. Its principal functions, according to Mr. Gatschet, are iterative and distributive. But the various modifications of meaning produced by redoubling the first syllable or the first two syllables of a word, with many euphonic changes, give nice distinctions, which enrich the language to a remarkable extent. Thus from *lama*, to be dizzy, we have *lemléma*, to reel or stagger; from *palah* or *pelah*, quickly, *pelpéla*, to work, to busy oneself at; from *tuēka*, to pierce, *tuektuéka*, to stare at, i.e., to pierce with the eyes; from *wita*, to blow (as the wind), *witwita*, to shake or struggle; from *mukash*, fine feathers or down of birds, *mukmukli*, downy, soft. The verb *lutatka*, to interpret, makes its frequentative mood by an abridged reduplication, *lultatka*, to interpret frequently, and hence we have the noun *lultatkuish*, a professional interpreter. So from *shiukish*, one who fights, a derivative of the verb *shiuka*, to fight, we have, by a twofold reduplication, *shishókish*, a warrior, and *shish'shokish*, a hero, one who has fought in many battles; and, in like manner, from *tamnuish*, one who is travelling (a derivative from *támenu*, to travel), we have *tatamnuish*, one who travels habitually, a stroller

[1] The first article — on the "Klamath Country and People" — appeared in the last number of Science. The third and concluding article — on "Klamath Mythology and General Ethnology" — will appear in the next issue.

or tramp; from *latcha*, to build, we have, in the frequentative or usitative form, *laltshish*, an architect; from *tedsha*, to wash, *tetádshish*, laundress. Almost endless examples might be given, showing the wealth of varied expressions which the language derives from this form of inflection.

Of the more ordinary class of inflections, derivational and grammatical, produced, like most of those in the Aryan tongues, by the agglutinative process, the Klamath has a vast number. Mr. Gatschet gives a list of formative affixes, filling more than a hundred quarto pages, and rivalling in extent and variety the list comprised in the second volume of Brugmann's "Comparative Grammar of the Indo Germanic Languages." The prefixes exceed fifty, and the suffixes two hundred. These affixes have sometimes internal euphonic inflections. The prefix *hash*, or *hesh*, for example, which forms causative, reciprocal, and reflective verbs, varies its vowel in a certain correspondence or euphonic correlation (though not always agreement) with the varying vowel of its radical. From *pan*, to eat, we have *háshpa*, to feed or cause to eat; from *uámpeli*, to recover, *heshuámpeli*, to restore to health; from *púnua*, to drink, *hushpanua*, to give to drink. *A* is a common suffix, which forms verbs from nouns, adjectives, and particles; *ka* is a "factitive" suffix, forming causative and transitive verbs; *ank* is the suffix which forms the present participle, like the Latin *ans* and *ens*, and the English *ing*. An example will show the fine shades of meaning in the derivatives formed by these suffixes. *Hewa* or *shewa*, to suppose, believe, think, coalesces with the reflexive prefix *hush* to form a new verb *husha*, to remember. The factitive affix *ka*, added to *husha*, produces *hushka*, to think about a thing, to study. The active participle of *hushka* is *hushkank*, thinking, studying. Adding to this the verb-forming particle *a*, we obtain the derivative verb *hushkanka*, to be reflecting or considering, to be in a certain mood or state of mind about anything. These word-forming particles yield an enormous addition to the Klamath vocabulary.

The declensions of nouns and adjectives resemble those of the Aryan languages, but are more extensive and more logically exact. There are fourteen cases, comprising, besides those of the Sanscrit, Greek, and Latin, several locative cases, and a temporal case. The latter ends in *emi* or *ăm*, and signifies "during" or "at the time of;" as from *skō*, spring, we have *skoémi*, during springtime; from *kish*, sunset, *kishémi* or (contracted) *kissăm*, at sunset. The accusative (or objective) case of "inanimate" nouns — corresponding to the Latin neuter — has (as in Latin) the same form as the nominative; but that of animate nouns ends in *ash*, or sometimes simply in *sh* or *a*. Thus *laki*, chief or head-man, has in the accusative *lakiash; muni*, great, has *muydnash*. The adjective agrees with its noun in case and number, though with some variations in the forms; thus from *muni laki*, great chief, we have in the genitive (or possessive) case *muydnam lakiam*, of the great chief; in the accusative, *muydnash* (or *munish*) *lakiash;* in the instrumental case, *muydntka lákitka*, by means of the great chief; in the directive case, *muydn'sh* (or *munish*) *lakiashtala*, toward the great chief, etc. The distributive form, which answers for the plural, has, in the nominative, *múmeni laláki*, each great chief; in the accusative, *mumidn'sh* (or *múmenish*) *laldkiash;* in the possessive, *mumidnam laldkiam*, of each great chief; and so on, through the various cases.

Space fails for describing the conjugations of the verb, except to mention the two participles, so curiously resembling the Aryan forms, namely, the present (or indefinite), ending usually in *ank* or *an*, and the preterite, ending in *tko* or *tk*; as from *koka*, to bite, *kokank* or *kokan*, biting, and *kokatko*, bitten. The substantive verb *gi* or *ki* (pronounced *ghee* or *kee*) has for its present participle *gian or giank*, being, and for its preterite *gitko*, been. As an auxiliary verb it is used, in its various inflections, with the past participle of other verbs to form the passive voice, as in *kokátko gi*, to be bitten; *kokátko giuapk*, will be bitten; *kokátko gít*, may be bitten; *kokátko giuga*, in order to be bitten. This substantive verb has a signification as abstract as the same verb in any Aryan or Semitic language, with often a wider compass of meaning, answering to both *ser* and *estar* in Spanish.

The pronouns, personal and possessive, are never combined with either the noun or the verb. What some grammarians have styled the transitions, and others the composite or objective conjugations, are therefore unknown to the Klamath, which in this respect is as analytic as the English or German, and far more analytic than either Greek or Hebrew.

Mr. Gatschet, after describing the great variety of structure in the American languages, varying from the extremely synthetic to the markedly analytic, observes that the Klamath "occupies a middle position" between these extremes, "but that, nevertheless, it shows very plainly all the characteristics of agglutinative tongues." He should have added — as his own minute and careful descriptions clearly show — "but not more plainly than these characteristics are displayed by the Sanscrit or the Greek." Liberal and philosophical as he is, he has not yet succeeded in entirely emancipating his mind from the influences of the Aryo-Semitic superstition, which is now in comparative philology what the geocentric superstition, before the time of Copernicus, was in astronomy. But he proceeds, in terms as accurate as they are elegant and forcible: "These and other characteristics impart to the language of the Maklaks a well-defined type, and approach it to the tongues of modern Europe, in which analysis has not preponderated over synthesis. An attentive study of the numerous texts obtained from the Indians [of which, it should be added, Mr. Gatschet's work furnishes an ample and most interesting collection] paired with constant comparison of Klamath structure with the structure of many foreign and American languages, could alone furnish a solid basis for establishing the grammatical rules of this upland tongue. The rhythmic, stately, and energetic tenor of its periods, especially those of the larger mythologic pieces, will please every student who has ever lent his attentive ear to the well-poised periods of Roman historians, and will even evoke comparison with them, not as to their contents, but as to the plan of the well-constructed sentences which appear in these narratives."

HORATIO HALE.

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IOWA ACADEMY OF SCIENCES.

As announced, the sixth annual session of the Iowa Academy of Sciences was held in DesMoines, on the 29th and 30th of December. Interest and enthusiasm were manifested throughout the session. Heretofore the annual meetings have been held in September, an unfortunate time for most of the scientific workers of the State. The following programme was carried out.

Professor C. C. Nutting, the president, delivered an address on "Systematic Zoology in Colleges." He urged the importance of systematic zoology in colleges. He thought

it unfortunate that the German craze for morphology should occupy so much attention in colleges to the exclusion of very important systematic work. He would not, however, belittle the work of the morphologist, since the whole structure of the systematic zoologist rests largely on the results of his labors. One reason why systematic work has failed to command the attention that it deserves on the part of the college student is a wide misapprehension as to its real nature and scope. A majority of students are wont to regard systematic zoology as particularly to be shunned on account of what they consider its most essential character — an endless succession of fearful names, a veritable nightmare of polysyllabic horrors, the dead languages resurrected for the special discomfort of the unfortunate student. Systematic zoology is much more than a collection of names. Classifications are but the skeletons which his studies and investigations should clothe with living facts, so that finally the dry bones will be almost forgotten as he contemplates the beauty and symmetry of the well rounded vital structure.

Professor F. M. Witter read two papers on "Arrow Points from the Loess" and "The Gas Wells near Letts, Iowa." The hills on which the city of Muscatine stands are covered with a very fine deposit of loess, which in some places must be nearly fifty feet thick. This loess abounds in land shells, the bones of at least two American reindeer, a considerable part of the antler of the elk or common deer. The ancient loess lake is nearly 150 feet above the present high-water of the Mississippi. In this loess deposit has been found an arrow point and a spear point. In it also occur fragments of the tooth of an elephant. Professor Calvin, in discussing this paper, remarked that arrow points had been found in the loess at Council Bluffs some years ago. He also referred to a skull found in Iowa that resembled the famous Neanderthal skull. That man was undoubtedly contemporaneous with the elephant shortly after the great ice age.

In speaking of the gas wells of Letts, Iowa, which have been flowing since December, 1890, Professor Witter thought it due to the decomposition of organic matter in the lower part of the drift material. Professors Call and Calvin both remarked that the flow of gas would not be permanent; it was wholly unlike the gas of Ohio and Indiana. Chemical examination has shown that this gas is closely related to marsh gas.

Professor Haworth read papers on "Melanite from Missouri," and "Prismatic Sandstone from Madison County, Missouri" (read with consent of the state geologist). He also presented a paper on "Limonite Pseudo-morphous after Calcite."

Professor J. E. Todd read a paper on "Striation of Rocks by River Ice." Specimens were exhibited showing striæ. These were observed at St. Louis, Cape Giradeau, Mo., and Sioux Falls, So. Dakota, also at several points along the Missouri. He also presented, by title, a paper on "Further Notes on the Great Central Plains of the Mississippi."

Professor Calvin gave an account, showing specimens, of the distinctions between *Acervularia davidsonii* and *A. profunda*. The species are quite distinct, not only does this difference appear in the external characters, but when they are polished. Both species occur in Iowa, sometimes in the same geological formation.

Professor Call spoke of "The Present Status of Artesian Well Investigation in Iowa." This work has been done in connection with the Iowa State Weather and Crop Service. The artesian wells are very numerous and extensive. Many of the so-called artesian wells are not artesian wells in the sense that Professor Call uses the term. As an instance, he cited the wells at Dunlap and Council Bluffs, which are not artesian, since water does not flow under hydrostatic pressure. Professor Todd took issue with him on this point. The wells at those places are on high elevated portions of the country. If they had been bored on lower ground, a short distance away, they would produce flowing water.

Mr. Charles R. Keyes presented three geological papers as follows: "Geological Structure and Relations of the Coal Bearing Strata of Central Iowa," "Brick and Other Clays of DesMoines," and "Aluminium in Iowa." The clay used at Hampton, Iowa, where a large stock company has recently been organized, is said to be the richest in the country, yielding eight ounces per bushel, or three ounces more than is produced in any known deposit of the neighboring States. Aluminium is soon to take the place of iron to a large extent in the arts, and the value of the early development of the industry cannot be overestimated. In speaking of the brick and other clays of DesMoines, he said that perhaps no province in the Union is better supplied with raw material of unexcelled quality for the manufacture of those objects commonly made from clay than our own State.

The only chemical papers were those presented by Professor G. E. Patrick. One was on "Sugar Beets in Iowa." Something over 500 samples from more than half the counties of the State have been analyzed. The results are highly gratifying. Though the sugar content on an average is less than in Nebraska, the yield is considerably more. More sugar can be grown on an acre in Iowa than in Nebraska. It was also shown that beets on the station farm, although under the best of culture, contained less sugar than those of Muscatine, which is owing to soil conditions. Certain portions of this State are apparently well adapted to the growing of beets for sugar production, and he mentioned the fact that of the 500 samples of beets recently analyzed at the Experiment Station, sent in from all parts of the State, the best have come — and in large numbers — from the regions about Davenport and Muscatine. He added, however, that "there may be other parts of the State just as well adapted to the beet-sugar industry as the localities here named." Professor Patrick's other paper was on the subject, "Can Fat be Fed into Milk, i.e., Can the Composition of Milk be Modified by Variations in the Kind of Food?" As opposed to the writings of several other scientists who deny food influence upon the composition of milk, he cited a number of European and American experiments, — one of which was recently performed at the experiment station at Ames, — which seem to prove conclusively that the kind of food fed to cows does have a material influence upon the percentage of butter-fat in the milk.

Professor S. E. Meek presented a paper "On the Fish Fauna of Arkansas and Iowa Compared." The river basins of eastern Iowa contain many more species than the river basins of the western part of the State. About 120 species occur in the State. Arkansas, which has not been thoroughly explored, contains 150; the darters being more numerous in Arkansas than in Iowa.

Professor R E. Call exhibited a specimen of "An Abnormal Hyoid Bone in the Human Subject."

Professor H. L. Bruner, in a paper on "An Aboriginal Rock Mortar," referred to relics found on the east slope of the Franklin Mountains, about eleven miles north of El Paso, Texas, and near the mouth of the "Hous Cañon."

Professor Tilton found near Indianola, Iowa, a three-legged snow-bird, which was exhibited. In domestic animals this

is not an uncommon occurence, though it is rather rare in wild animals

Four entomological papers were read. Professor Herbert Osborn presented two, on "The Orthopterous Fauna of Iowa" and "Notes on Certain Iowa Diptera." Sixty-seven species were enumerated. The notes were based on specimens found almost entirely in the central part of the State. The Orthoptera are among the most important of the injurious insects of this State, almost all the species being destructive, and scarcely one that can be considered as of any benefit. A Texas species, *Arphia conspersa*, was reported from Ames; *Periplaneta orientalis*, apparently confined to larger cities; and *Platamodes pennsylvanica*, very common in doors and out. Professor Osborn and H. A. Gossard presented some "Notes on the Life History of Agallia sanguinolenta." This leaf-hopper, though a clover pest, also feeds on beets, rutabagas, cabbages, and blue grass. It is active even in mid winter, on sunshiny days. The first brood of larvæ appear between early May and July 1. The earliest individuals of the brood are nearly matured by the first of July. Larvæ can be found, in all stages, from this time until the advent of winter. Most of the individuals are believed to be included in two broods.

Professor C. P. Gillette, in a paper on "How the Female of Cacœcia semiferana Protects Her Egg-Clusters," stated that one of the most novel methods is that employed by the box-elder leaf-roller. The egg patches are covered over with a gluey material, and this is nearly always completely covered with a dense mass of scales placed like shingles on a roof. These scales closely resemble those found on the under side of the abdomen.

Professor T. H. McBride gave a talk on "Slime Moulds of Iowa." These organisms are especially interesting not only because of the beauty of the structures themselves but also on account of their relationships to other living things. Are slime moulds plants or animals? The slime moulds of Iowa need investigation. Our flora (regarding them as plants) is comparatively rich in this direction. The proper reference of fruit to plasmodium is as yet little known in many species. Slime moulds exhibit periodicity in their appearance,—sometimes fail in a given locality for years, and then abundantly reappear.

Botanical papers were presented by Professor L. H. Pammel. One was on "Bacteria of Milk." A large number of cultures were exhibited. In the "Report of Committee on State Flora" several interesting species new to the State were mentioned. Muscatine seems to be especially favored with some southern plants, like *Rhexia Virginica*, *Carya olivæformis*, and *C. sulcata*. Weeds like *Solanum rostratum*, *S. carolinense*, *Cuicus arvensis*, etc., are spreading. A third paper was presented on the subject of "Phænological Notes." One of the interesting questions in connection with our flora is the relation that climate has to our wild plants, the time of leafing, flowering, and fall of leaves, as well as the effects of frost on plants. In 1886, the soft maple (*Acer saccharinum*) was in flower on Mar. 22; in 1891, Apr. 11. *Ulmus Americana*, in 1886, in flower, Apr. 12; in 1891, Apr. 18. The succession of flowers in herbaceous plants in 1886 and 1891 was: *Hepatica acutiloba*, Apr. 9 (1886), Apr. 12 (1891); *Capsella Bursa-pastoris*, Apr. 15 (1886), Apr. 24 (1891); *Mertensia Virginica*, Apr. 20 (1886), Apr. 28 (1891). Frost and its effects on some plants were noted: *Portulaca oleracea*, early in September, tips frost-bitten; Oct. 7, more or less destroyed; Oct. 9, plants black in an open field; *Panicum sanguinale*, injured seriously on Oct. 8; *Borrago officinalis*, Oct. 22, a few leaves affected; Oct. 23, many leaves killed; *Scabiosa atropurpurea*, Oct. 7, no injury; Oct. 23, no injury; Nov. 11, no injury; Nov. 21, some injury to leaves. In a paper on "Experiments in the Prevention of Corn Smut," made at the Iowa Experiment Station, it was shown that by treating seed corn with ammoniacal carbonate of copper and copper sulphate no beneficial results were obtained. In plot No. I., treated, there were 6 smutted plants against 8 in check; in plot II., 6 smutted plants against 7 in check; in plot III., 42 smutted plants against 38 in check; in plot VII, 38 smutted plants against 32 in check. These experiments should not be considered as showing conclusively that smut does not enter the delicate tissues of corn by way of the seed. Incidentally he referred to some experiments now carried on at the college farm, in which ammoniacal carbonate of copper, Bordeaux mixture, and other substances were mixed with soil, in which, afterward, corn was planted. Ammoniacal carbonate of copper in the soil retards the germination of corn.

The following papers also appeared on the programme: Miss Minnie Howe, "Some Experiments for the Purpose of Determining the Active Principles of Bread Making;" Dr. N. B. Niles, "The Action of Disinfectants on Nutrient Media;" Professor J. S. Tilton, "Erosion by Middle River for November, 1891."

A committee of five was appointed to ask the legislature to print the Proceedings in connection with the Annual Report of the Iowa Weather and Crop Service. Mr. J. R. Sage, Professors Nutting, Haworth, Davis, and Pammel constitute the committee. The officers of the Academy for 1892 are: C. C. Nutting, president, Iowa City; L. H. Pammel, first vice-president, Ames; E. Haworth, second vice-president, Oskaloosa; Herbert Osborn, secretary and treasurer, Ames; executive council, the officers and J. E. Todd, Tabor; F. M. Nitter, Muscatine; and R. E. Call, DesMoines.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

Traumatic Hypnotism.

HYPNOSIS is a psychical state in which an individual is more than usually susceptible to suggestions. As is well known, the degrees of suggestibility are many. Making the distinction between physiological and pathological hypnotism, the traumatic hypnotism would, of course, fall under the latter head. We have been led to employ the term "traumatic," from an investigation of the following case. The case is all the more interesting, since the patient is a physician.

Patient says: "I was in a village cart coming up the street; the horse was spirited; a man tried to stop him from running away. The last thing I remember is calling to him to get out of the way. The following (of which I was unconscious) has been told me by others: the cart struck another wagon and threw me into the air, and I came down in a heap, as if one were going to dive into the water, striking on my back and side, having the lines wound around my hands. I was pulled forward and up by the horse starting, and dragged about twenty feet, when the lines slipped off of my hands. I did not say anything at this moment; they picked me up for dead and carried me into a drug store. I then began to talk with them, looking deathly pale. They asked me if I was hurt, I answered, 'No, not at all, I am all right.' I would moan every now and then during the conversation. Quite a number of my friends came in, and I called one by name. Then I took off my bonnet and walked back where I could wash my

face and hands; I moaned all the time I was doing this; they all thought I knew what I was doing. I walked out towards the hack, but told them I preferred to wait till the crowd got out of the way. On the way home my daughter got into the hack, and I told her not to worry, that I was all right. I walked from the hack into the house. The doctor asked me to sit down, but I said I did not dare to, for I should lose control of myself. I asked to have a pin taken out of my dress. They gave me some whiskey. Then I suggested if it would not be a good idea to take a hot bath. My daughter asked me where the arnica was, and I told her in the office on second shelf, which was correct. Then they gave me the hot bath, and while the servant was pouring some water on my head I came to myself for the first time since calling to the man to get out of the way, but only for a few seconds, hearing only voices and feeling something strike my head, giving pain. I was then taken out of the bath and put into bed; I told them how to unfold the bed; then the doctor put a saturated cloth on the wounded part of my head; I told them to get towels and put them on the pillow to prevent soiling it. Then I began to be very delirious [patient now passes from hypnotic into a delirious state], and talked incessantly about a railroad accident; my husband is constantly on the road and I have worried sometimes about it. I repeated the same things over, saying the railroad switch was wrong, etc. This delirium lasted about an hour. The surgeon arrived, and on putting his finger between the scalp and skull I felt a flash of lightning and saw it. I said 'I cannot stand this pain,' and then I became conscious for the first time of the injury on the back of my head. I was in agony, I could feel distinctly a grating when his finger was put under the scalp, and on pressure in one spot there was a bubbling sensation, that seemed to shoot right over the brain. During this time I was conscious, but did not see anything. It is three weeks since the accident occurred, and I have had headache continually, being a re-echo of the old pain. When I try to read, the right eye sees double; my head feels double; the wounded side feels thick; I have had very unpleasant dreams since."

According to the description of the surgeon, the wound was on the right parietal protuberance over the third descending convolution; it was a contusion.

Inquiries of those who saw the accident and subsequent events confirm the statement of the patient. When picked up her eyes were closed; then water was poured on her head, and she opened her eyes; she could not quite remember her husband's name; then she said she felt better and went and washed her face, etc., as already described.

It is interesting to note the states of consciousness: first, unconsciousness at time of accident; then, water being poured on her head, patient passes into the hypnotic state; this lasts nearly an hour, during which she so conducts herself that her friends do not suspect but that she is herself. During this hypnotic state suggestibility may be said to have been normal, since she responded to every one naturally. Her normal self seemed to control her hypnotic self fully; this latter self was the only one during the hour which was conscious.

Arthur MacDonald.

Georgetown Medical School, Washington, D.C.

Cold Waves.

In the December number of the *American Meteorological Journal* Dr. A. Woeikof has presented a paper on cold waves, in which he attacks with some force views which have been expressed by Professor Russel. The belief that a cold wave is due to the passage of a mass of cold air, which has a vertical diminution in temperature of 1° in 180 feet, at twenty or more miles per hour, over the earth's surface heated sometimes 30° or 40° above the air in contact with it, for a distance of 2,000 miles, without accretion or reinforcement, is certainly unique. It is certain that Dr. Woeikof will not recognize this as his view. He will say that the cold will be added to by radiation from the sod or soil, all the more intense because of the clear, dry air of the cold wave. When we think, however, that, as the cold wave advances at great velocity, the earth's surface is frequently 40° warmer than the air immediately in contact with it, it is difficult to see how the earth's surface can do aught except warm up the air. It seems an inevitable conclusion that a mass of cold air, passing in any direction over the earth, which is itself heated many degrees above the air, must inevitably lose its characteristics in a very short time.

If Dr. Woeikof could study only a very few of our cold waves he would very quickly change his belief. He is at a great disadvantage in that he resides in a country where they have no cold waves, properly speaking. It is well known that in Europe the high areas remain nearly stationary for weeks at a time, and as a result a very abnormal condition of temperature supervenes. The sun shining upon stagnant air heats it up, and this effect becomes cumulative, a little more heat being added each day; besides this, the earth's surface, in this stagnant air, cools down by radiation, as a consequence it frequently happens that the earth's surface is cooler than the air at 10,000 feet; and this has given rise to the most extraordinary theory and one that directly contradicts all known orthodox hypotheses, namely, that in our high areas the air is abnormally heated, while in our storms it is abnormally cooled. It is evident that no discussion of cold waves can be intelligently carried on under such conditions. Dr. Woeikof also suggests that observations at Pike's Peak might be of assistance in studying these phenomena, but this cannot be done at that point for this reason. Pike's Peak is situated on the edge of a plateau about 4,000 feet above sea-level and abnormally heated; also, on the east, there is a marked falling off of the plateau. In consequence, the summit sometimes has the temperature of the plateau and sometimes that of the eastern plain. No cold waves pass over the summit, for the reason that the mountains form a barrier. Most of the cold waves pass down from Manitoba or Assiniboia far to the east or north-east of the mountain.

It would appear that one or two considerations which have an important bearing on this question have been overlooked. For example, it is not proper to think of a cold wave as a mass of cold air having a uniform velocity throughout its height. It is well known that, owing to friction with the earth's surface and other obstructions, the velocity of the air at the earth is much less than at 6,000 feet. It is probable that on Mt. Washington, during the passage of a cold wave, the velocity of the wind is double that at the base. We may consider that the velocity increases uniformly up to this height, or at 3,000 feet it would be about midway between that at the earth and that at the summit. The consequence of this is readily seen. A point in a layer of air at the earth, moving 20 miles an hour, in 10 hours would be 200 miles from its starting-place, but at 6,000 feet a point in the layer would be 400 miles from its first position. If we suppose the temperature diminution in height is 1° in 180 feet at the beginning, and the horizontal temperature difference at the same time is 40° in 200 miles, then, at the end of 10 hours, the vertical diminution in height would become about 1° in 90 feet. The temperature distribution in the latter case would cause a serious disturbance in the equilibrium, according to orthodox views, and there would be an upsetting of the layers, and, in consequence, the cold of the upper layers would ultimately reach the earth. Of course in nature there are no such violent changes, except rarely in summer time, but such an interchange must take place by degrees.

The observations at Mt. Washington abundantly bear out this view. These have been recently published by the Weather Bureau in curves for January, February, and March ("Monthly Weather Review," July to Oct., 1891). On examining the curves we find that in front of a cold wave the diminution of temperature with height is much increased, frequently to more than double the normal, while after the cold wave the temperature is frequently *lower* at the base than at the summit. In other words, the cold wave reaches the summit 5 to 8 hours before it does the base, and the warming up also lags behind, at the base, the same length of time. A neglect of this consideration lies at the bottom of many of Dr. Hann's vagaries regarding temperature distribution in cyclones and anticyclones. Now, if a cold wave is composed of layers of air moving at different velocities as we recede from the earth, it is easy to see that the velocity of the air at the earth need not be that of the cold wave, for the upper layers of

air would flow over the lower, bearing along the cold wave, and this cold air would gradually work its way down to the earth.

Until we can obtain observations in free air we must be content with hypotheses and careful study of mountain observations. While no present hypothesis will prove satisfactory in all its details, owing to our ignorance of upper air conditions, yet we can rest assured that the view at the opening of this discussion can by no possibility be correct. E. N.

BOOK-REVIEWS.

The Philosophical Review, Vol. I., No. 1. Edited by J. G. SCHURMAN. January, 1892. Boston, Ginn & Co.

THE establishment in this country of a review devoted to pure philosophy is a noteworthy event, and may prove an event of real importance. The *Review*, we are informed, is to receive "support from private endowments, so that its financial basis is sound and durable;" and though the source of this support is not mentioned, it may be inferred from the fact that the copyright is held by the treasurer of Cornell University, the editor being professor of philosophy in the same institution. The mechanical appearance of the *Review* is similar to that of the *Political Science Quarterly*, the present number containing a hundred and twenty-eight pages. It will be published bi-monthly at seventy-five cents a number or three dollars a year. The editor contributes a prefatory note, in which he announces the character and scope of the *Review* and the attitude it proposes to take. "It will aim at the organization, the diffusion and the increase of philosophical knowledge and activity in America," and "will be an organ through which investigators may make known to their fellow-laborers the results of their researches and reflections." The editor takes a roseate view of the prospects of philosophy in America, but the reasons he assigns therefor, except the freedom of American life and thought, do not seem very cogent. It is true that there is now a certain movement of philosophic thought in the country; but it seems to us to be shallow, and no philosopher has yet appeared among us capable of original thought. The *Review*, we are told, "will not be the organ of any institution, or of any sect, or of any interest," but will maintain "impartiality and catholicity of tone and spirit." This is a good rule if well followed; but observation has convinced us that an editor's predilections seldom fail to show themselves in his selection of material. Professor Schurman's views of what is needed in philosophy at the present time seem to us in one respect mistaken. He holds that philosophers ought to devote themselves to the cultivation of special departments, such as logic, psychology, the philosophy of education, etc.; whereas to our mind the crying need of philosophy just now is the relaying of the foundations, and until this is accomplished we see little prospect of fruitful work in any special department.

The leading articles in this issue of the *Review* are three in number, of which the most important is that of Professor Ladd on "Psychology as So-called Natural Science." It is really a critique of Professor James's theory of the nature of psychology and the method of studying it; and the writer has little difficulty in showing that the theory is untenable, and furthermore that Professor James himself is unable to adhere to it with any consistency. Professor John Watson criticises Kant's philosophy from the standpoint of Hegelism, and though his article contains nothing new, it is interesting as renewed evidence that Kant's disciples have become dissatisfied with the outcome of his teaching. Mr. B. I. Gilman contributes the first instalment of a paper "On Some Psychological Aspects of the Chinese Musical System," which shows much curious study, but which seems out of place in a philosophical magazine. Of the book-reviews, which are quite numerous, the ablest is that of Herbert Spencer's "Justice," by the editor of the *Review*, in which he takes essentially the same view of Spencer's doctrines that was taken in these columns when the book was first published. The other reviews are of varying degrees of excellence, some very good and others rather inferior. We must add, too, that some of the books reviewed are not worthy of any notice at all. The concluding portion of the *Review* consists of abstracts of articles in various philosophical magazines — a new feature, we believe, in a periodical of this sort, and one likely to be useful. On the whole, the *Philosophical Review* promises fairly well, and we hope it will prove worthy of its mission.

AMONG THE PUBLISHERS.

THE January number of the *Review of Reviews* contains, as its most conspicuous feature, a sketch of the Czar and the Russia of to-day, written particularly for the American edition of the *Review*, by Mr. W. T. Stead, the English editor. The article contains a number of portraits, and — what will be particularly interesting — a map showing the famine districts, and another showing the so-called "Jewish Pale," the district within which the Jews are permitted to live.

— Macmillan & Co. have in press a translation of Kant's "Kritik der Urtheilskraft," by the Rev. J. H. Bernard, fellow and lecturer of Trinity College, Dublin, and joint author with Professor Mahaffy of "Kant's Critical Philosophy for English Readers."

— Ticknor & Co., Boston, announce "The Norman Monuments of Palermo and Environs," by Arne Delhi and G. H. Chamberlin, architects, in four parts, with fifty measured drawings, several cuts in the text, and many photographic views. The edition will be limited and sold by subscription.

— Readers of Carlyle have often inquired whether it was possible to obtain some accurate text of the course of lectures on literature which he delivered in 1838. They will, therefore, be glad to hear that these lectures are now about to be published by Ellis & Elvey of London. The text now to be issued is derived from the report taken at the time by the late T. C. Anstey, two separate transcripts of which have been in the hands of the publishers.

— An account of that mysterious malady, the grip, by Dr. Cyrus Edson, the chief inspector of the New York Health Department, is published in the January number of *Babyhood*. Dr. Edson traces the history of the grip from ancient times to the present day, describes the symptoms and the mode of treatment, and furnishes valuable aids in the direction of prevention. "Crying and its Significance," by Dr. John Dorning, and "Fat and Thin Children," by Dr. W. L. Carr, are articles that will prove interesting to the readers of that monthly nursery guide. Among the numerous other contributions may be mentioned: "Keeping the Baby Warm," "Children's Lies," "Experiences in Feeding," and a full supply of "Nursery Problems."

— The January number of the *Annals of the American Academy of Political and Social Science* contains two papers on municipal government. They are the article on "The Study of Municipal Government," by Frank P. Prichard, and the article on "The Political Organization of a Modern Municipality," by Wm. Draper Lewis. This number also contains a copy of the by-laws of the Philadelphia Municipal League, an organization whose purpose is the divorce of municipal from national politics. Among the other leading articles in this number are "The Basis of the Demand for the Public Regulation of Industries," by W. D. Dabney, "International Arbitration," by Eleanor L. Lord, a strong plea for arbitration as a means of settling international disputes, in place of war. "Jurisprudence in American Universities," by Professor E. W. Huffcutt, a paper of interest to all law students; and "Instruction in French Universities," by Leo S. Rowe. Mr. Rowe has been a student in Paris for the past year, and his paper explains very fully the courses and method of instruction in the colleges of France. A new department has been added to the *Annals*. It is entitled "Discussion," and contains papers written in answer to articles which have appeared in the *Annals*. This number also contains the proceedings of the tenth scientific session of the academy, which was held in Philadelphia in November. In the Department of Personal Notes in the January *Annals*, there are brief biographical sketches of the following workers in the field of political and social science: W. C. Ford of Columbia College; A. C. Miller of Cornell; D. E. Spencer of Harvard; George E.

Howard of Leland Stanford, Jr., University; H. V. Ames of the University of Michigan; W. H. Mace of Syracuse University; Ernest Mischler of Prague; R. H. Inglis Palgrave of London; the late Alfred Jourdan of Aix; Paul Heilborn of Berlin; A. Brückner and George Staehr of Kasan.

— A Spanish edition of the Story of the Nations series is being issued in Madrid under arrangements with the Putnams. Gilman's "Story of the Saracens" in this series is now being printed in raised letters for the use of the blind. The next volumes to be issued in the series are Freeman's "Story of Sicily," Oman's "Story of the Byzantine Empire," and Miss Duff's "Story of the Tuscan Republics."

— With the number for January, 1892, the *Educational Review* opens its third volume. Professor Jenks of Cornell has a paper on "Educational Values," particularly with reference to the college curriculum, and controverting the position taken by Professor Patten in an earlier number. Superintendent Marble of Worcester, Mass., makes some practical suggestions concerning the teaching of the effective use of English. Professor Richards of Yale contrasts the old and the new methods of teaching geometry; and Principal Grant of Queen's College, Kingston, Ontario, replies to Bishop Spalding's earlier argument for religious instruction in State schools. Important articles appear also on school savings banks in England, and the effect of manual training upon health. The discussion on city school supervision is continued by Superintendent Tarbell of Providence, and that on practice teaching by President W. J. Hilne of Albany. Other discussions are by the editor in-chief and Principal Owen of Saco, Me. Book reviews are contributed by Professors McLaughlin and Cameron of Yale, Oren Root of Hamilton, Gill of the Smithsonian Institution, and others.

— *The Electrical Engineer* will begin the new year with a series of articles on the electrical and magnetic discoveries of Professor Joseph Henry — the Faraday of America — by his daughter, Miss Mary A. Henry of Washington, with notes by Mr. Franklin Leonard Pope. Additional and pathetic interest is given this series by the fact that it is practically a vindication by filial hands of Henry's claims to the discovery of magneto-electricity, at a time when his work has been suffered to fall into neglect and oblivion. At the recent Electrical Congress at Frankfort, Germany, the proposition of the American delegates to name after Henry an important new unit applying to facts that he was the first to observe and investigate, failed of assent, and was postponed until the Chicago Electrical Congress of 1893, many of the European delegates saying they had never heard of Henry.

— We may regard it as certain that an apparent connection between infectious diseases and atmospheric conditions had suggested itself to the medical mind long before Sydenham attributed

CALENDAR OF SOCIETIES.

Philosophical Society, Washington.

Jan. 2.—F. H. Newell, Fluctuations of Discharge of Western Rivers; J. R. Eastman, The Mexican Meteorites.

Society of Natural History, Boston.

Jan. 6.—Percival Lowell, Shinto Occultism from a Scientific Standpoint; E. S. Morse, On the Form of the Ancient Bow in Various Parts of the World.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

WANTED.—*Science*, No. 178, July 2, 1886, also Index and Title-page to Vol. VII. Address N. D. C. Hodges, 874 Broadway, New York.

A YOUNG MAN (31) would like a position in a college, laboratory, or observatory, is also willing to assist at a steam engine, etc. Address J. W., care of *Science*, 874 Broadway, New York.

WANTED.—A position in the philosophical or pedagogical department of a college or university by a young man (30) who has had five years' practical experience in teaching, and who has done four years' post-graduate work in philosophy, devoting his attention during the last two years especially to study and original investigation in scientific psychology and its applications in education. Address E. A., care *Science*, 874 Broadway, N. Y. City.

WANTED.—A suitable position in Washington, D. C., not connected with the Government, and with a salary not to exceed $650 a year, by an experienced biologist with six years' university training. Applicant has been a skilful surgeon for fourteen years; is a practical photographer, cartographer, and accustomed to the use of the typewriter. He is also capable of making the most finished drawings, of any description, for all manner of illustrative purposes in science; trained in museum methods and work; also field operations and taxidermy in its various departments, and modeling, production of casts, restorations of paleontological specimens and similar employments. Address U. S. B., care *Science*, 47 Lafayette Place, N. Y.

WANTED.—By a young man (27), B.A. and Ph.D., with three years' experience as assistant in chemistry, position as instructor in chemistry or in natural sciences in college or academy, or other advantageous position as chemist. Give particulars as to work, salary, etc. F. W. MAR, L. Box 28, West Haven, Conn.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

Wanted to buy or exchange a copy of Holbrook's North American Herpetology, by John Edwards. 5 vols. Philadelphia, 1842. G. BAUR, Clark University, Worcester, Mass.

For sale or exchange, LeConte, "Geology;" Quain, "Anatomy," 2 vols; Foster, "Physiology," Eng. edition; Shepard, Appleton, Elliott, and Stern, "Chemistry;" Jordan, "Manual of Vertebrates;" "International Scientists' Directory;" Vol. I. *Journal of Morphology;* Balfour, "Embryology," 2 vols.; Leidy, "Rhizopods;" *Science*, 18 vols., unbound. C. T. McCLINTOCK, Lexington, Ky.

For sale.—A 6½ x 8½ Camera; a very fine instrument, with lens, holders and tripod, all new; it cost over $40; price, $25. Edw. L. Hayes, 6 Athens street, Cambridge, Mass.

To exchange Wright's "Ice Age in North America" and Le Conte's "Elements of Geology" (Copyright 1882) for "Darwinism," by A. R. Wallace, "Origin of Species," by Darwin, "Descent of Man," by Darwin, "Man's Place in Nature," Huxley, "Mental Evolution in Animals," by Romanes, "Pre-Adamites," by Winchell. No books wanted except latest editions, and books in good condition. C. S. Brown, Jr., Vanderbilt University, Nashville, Tenn.

For Sale or Exchange for books a complete private chemical laboratory outfit. Includes large Becker balance (200g. to 1-10mg.), platinum dishes and crucibles, agate motors, glass-blowing apparatus, etc. For sale in part or whole. Also complete file of *Silliman's Journal*, 1862-1885 (62-71 bound); Smithsonian Reports, 1854-1883; U. S. Coast Survey, 1854-1869. Full particulars to enquirers. F. GARDINER, JR., Pomfret, Conn.

For exchange or sale at a sacrifice, an elaborate microscope outfit. Bullock stand; monocular objectives, one-sixth homeogeneous immersion, four-tenths, and three-inch, Bausch & Lomb, also one-fourth and one inch Spencer. Four eye-pieces. Objectives are the best made. Address Mrs. Marion Smith, 41 Branch Street, Lowell, Mass.

to the atmosphere an "epidemic constitution." The influence of weather would be measured by its effect in providing an environment suitable to germ development. Thus moist weather, whether bleak or warm, would be found conducive to the spread of contagia, and so it is. This fact has often been attested by the extension of cholera, diarrhœa, and the exanthemata. A warm and dry day, on the contrary, tends to check morbid action of an infectious kind. This fact is susceptible of more than one explanation. We may, on the one hand, says *Lancet*, regard it as a consequence of the absence of that germ-fostering condition — humidity; on the other, we cannot fail to be reminded that dry warmth and sunshine give the signal for an exodus from many crowded homes, for their freer ventilation, and consequently for diminution in the intensity of contagia. The exact value of weather changes in regard to this class of diseases, however, still is and must for some time remain *sub judice*. As for the ailments more usually associated with these changes — those, for example, more commonly known as inflammatory — the connection is here much more evident, and also in all likelihood, more direct. The association of pneumonia, bronchitis, asthma, and rheumatism with bleak and wet weather is too invariable to permit of our doubting its reality apart from any suggestion of septic agency.

— Mr. Kelway, according to *Industries*, has introduced an exceedingly simple system of signalling at night. A board is provided with incandescent lamps arranged so that different sets form different letters. If the letter N is wanted, for instance, a key is pressed which lights all the lamps which go to form this letter, and so on. The machine can be worked like a typewriter. Signalling by this means corresponds with the use of the blackboard in the daytime, but is, of course, much more rapid, and at the same time more easily followed. It is, of course, incomparably more rapid than any system of flash signalling, and is easy to read.

SCIENCE

A WEEKLY NEWSPAPER OF ALL ARTS AND SCIENCES.

PUBLISHED BY N. D. C. HODGES, 874 BROADWAY.

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QUERY.

Can any reader of *Science* cite a case of lightning stroke in which the dissipation of a small conductor (one-sixteenth of an inch in diameter, say,) has failed to protect between two horizontal planes passing through its upper and lower ends respectively? Plenty of cases have been found which show that when the conductor is dissipated the building is not injured to the extent explained (for many of these see volumes of Philosophical Transactions at the time when lightning was attracting the attention of the Royal Society), but not an exception is yet known, although this query has been published far and wide among electricians.

First inserted June 19. No response to date.

N. D. C. HODGES,
874 BROADWAY, NEW YORK.

SCIENCE

NEW YORK, JANUARY 22, 1892.

"DIVINE HEALING."[1]

ABOUT twenty years ago a half-educated trifler from Germany, babbling, as they all do now, a travesty of undigested "metaphysical philosophy" displayed in a nimbus of religious cant, concerning whom the most injurious reports were circulated and have never been contradicted — this man became the apostle of a large following, and the worthy founder of the most notorious of the "schools" spawning ever since in the shallow waters of "Christian science," and there is of late a pitiful increase of faith, particularly on the part of religious people, in the prayers, promises and neglect of these healers, until cancer, diphtheria, and typhoid are left without challenge or remorse in the control of "Divine Healers," "Christian Scientists," "Faith" and "Mind Curers," and "inspired" persons in all garbs, who advertise variously, while each calls all others "quack."

Here is a "philosophy" which literally insists that there is neither pain nor disease;[2] cancer is an imagination. How patient, after all, are our legislators!

Serious argument against the hypocritical nonsense of these parasites in the medical profession would hardly have seemed called for, — so silly is the silliness, so crazy the craze, — were it not true that their influence is widely and perniciously felt. As keen an observer as Mr. Edward Eggleston has thought the status of "Christian Science" so serious an evil that his last work, "The Faith Doctor," is a strong indictment of its murderous counsels.

Popularity is easily gained, for the dead tell no tales. Christian Science murmurs its experimental prayer over the sick as material, while its triumphal march gathers a noisy ovation from the imaginative, the neurotic, the convalescing, and from certain surgical cases, stiff-jointed, rheumatic, or weak, and simply needing reassurance to take up beds and walk. From New England to the extreme West, towns and communities swarm with the new "practitioners." "The number of these regularly graduated cannot be accurately estimated, but they are numbered by the thousand. Within the limits of one school there are about thirty organized churches, and also one hundred and twenty societies which maintain regular services."[3]

Numerous periodicals make their appeal in such priestly vestments as have never been assumed by *Ayer's Almanac* or the most plausible of the *Guides to Health*. Twenty-three institutes, scientific and metaphysical, are advertised in one periodical.[4]

Here whoever listens becomes a titled practitioner (C.S.) and is "inspired," however brief the course of instruction. "There are about fifty dispensaries and reading-rooms, and a rapidly increasing literature for Christian Science; one of the other schools, Mind Cure, has also a large number of organizations similar in character."[5]

Reputable physicians occasionally yield to the importunities of patients, or the specious argument from the assumed standpoint of religion, and endorse the practice of Faith Cure, wholly or in part. Given an inch, an ell is taken, and the fanatical statement has already been made that there exists no opposition to Divine Healing on the part of medical men.[6]

Yet every veracious medical article and authentic report written during the past decade to show the service of air, diet, exercise, baths, or medication, is the enlightened protest of science, i.e., of confirmed and verified experience, in opposition to sensational, hysterical, superstitious pseudo-science.

Concession on the part of any physician to the childish credulity of a bygone age is simply high treason to his noble profession. A medical man who is still conducting cases of successful treatment should reflect upon his ingratitude to Alma Mater, and upon the comment which must greet a step which seems to stultify his own professional life and give support to a dangerous class in the community. His colleagues will, inevitably, question his sincerity and ask for a logical defense.

Religious observances have their time and place, but the Almighty evidently always employs means; the preachers are accepted agents in matters spiritual, perhaps the doctors are the convenient instruments to cure disease.

A disorder so serious, visible, established, and contagious as diphtheria, is not to be left to faith and prayer alone. The writer has never seen a cure wrought by such agency; but he has met with several instances where, in this disease, faith without works has brought about a most disastrous result. Prayer accompanying unskilled attendance in childbed has proved to be infanticide.

The fact remains (statistics are stubborn) that "The Prayer Test" submitted some years ago was unsuccessful in application, both here and in England, and it is not now referred to by those who so confidently offered it.

Consumption is unwisely chosen as a chief example of the hopelessly incurable, therefore to be abandoned to prayer.[7] Dr. Cullis has here failed to help;[8] the bacteria still defy his methods. But medical science accomplishes very much in this disease, more and more from year to year. Even the removal of patients to antiseptic air and a warmer climate completely cures in many instances. Dr. Burnett recently reported fifty cases of advanced consumption of the lungs cured in England in spite of the climate, and medical authorities are nearly unanimous in promising aid at early stages of phthisis. Why should we, so equipped with books, professional training, experience, and a sense of responsibility toward our fellows, abandon the care of consumption to the pseudo-scientists?

[1] A portion of this paper was published in Boston Transcript, Dec. 21, 1891, in reply to a communication, Boston Transcript, Nov. 7, favoring Divine Healing as "the more excellent way."

[2] "Science and Health," pp. 188, 190, 231, etc. "You say a boil is inflamed and painful, but that is impossible" (231). "Inflammation, tubercles, hemorrhage and decomposition are but thoughts, beliefs" (188).

[3] American Spectator, Dec., 1891.

[4] Christian Science Journal, Jan., 1892.

[5] Am. Spectator, Dec., 1891.

[6] Journal of the Evangelical Alliance, Nov. 14, 1891.

[7] Boston Transcript, Nov. 7; Chr. Science Journal, Jan., 1892; Science and Health, p. 188.

[8] In the Consumptives' Home, a large faith institute, located in Boston.

It is most emphatically true, and to be recognized by every thoughtful mind abreast with the currents of modern life, that, underneath all the enormous quackery and folly of the healers, there are certain tendencies in the movement which are true and which have given to it power and influence. An influence early seen among us, and which, we trust, will be perpetuated as a final boon to the sick, was the leading of popular thought, in a hard and sceptical time, into a more spiritual conception of disease. Rightly applied, and by educated persons, such forces in nature as mesmerism (hitherto misapplied), and the still questionable hypnotism, seem destined to be of inestimable service in the treatment of all sickness, most obviously in disturbances of the nervous system.

Happily,

> "The qualities that soothe and heal and bless
> Are scattered at the feet of men like flowers."

There are men and women everywhere who forget fear and self and give out their beautiful life to the sick. No intelligent physician now neglects the mental, even the psychic states of his patients. Subtle gifts and powers are seen in the highest, or philanthropic, type of the medical man; fortunate is the patient whose doctor adds all noble ways and works to his professional acquirements. Abercrombie, Bigelow, and Clark were, temperamentally, sunshine, faith, patience, and hope.

Such ministrations are, however, but accessory to medical treatment, and should not arrogate the powers and functions of science,

> "For who shall change, by prayers or thanksgivings,
> The mystery of the cruelty of things?"

When the son of Mr. Moody, the revivalist, lay sick of scarlet fever, Mr. Moody's daily prayer, thousands helping him in the great tabernacle, was for the doctor's guidance. "May my boy's doctor be directed, and may he save my child!" That doctor's attitude toward revivals was so questionable that the boy's cure by prayer in this partnership was one among numerous modern miracles. But the M.D.'s chosen by D.D.'s are quite apt to be unbelievers. Even missionaries are shockingly delinquent in this matter, and waste no time by employing the mongrel attachés who follow the fathers, if only a scoffer full of knowledge be at hand. How often has the writer seen this wise prudence exercised by the mission leaders of the Sandwich Islands.

Perchance, to aid us all, a class of honest healers or helpers will at last arise whose representatives may not call themselves divine, and may not assume to cure all contagious and organic disease.

I venture, finally, to apply to the mental healers(?) words of an eloquent writer directed against others accused of like delinquency: "They trust to nature, which cannot, like an intelligent surgeon, bring together the gaping lips of a wound, and by their union effect a cure; which, not knowing how to tie a wounded artery, suffers a man in full health and energy to bleed to death; which, in order to remove a splinter from the cornea, destroys the whole eye by suppuration. In an affair so important as that of healing, a profession requiring such intelligence, judgment, and skill, how could they blindly take the vital power for their best instructor and guide, whilst reflective reason and unfettered judgment, those magnificent gifts of the Deity, have been granted to man to enable him infinitely to surpass its performances for the benefit of mankind?"

C. F. NICHOLS, M.D.

NOTES AND NEWS.

THE *Illustrated American* says: "It has been decided that it is necessary to send an expedition to Greenland this year to rescue Mr. Peary and his party. The necesity being admitted no one will object to the relief expedition. But it does seem proper to recall some of the conditions under which the original party started. Mr. Peary sought, before his departure, to inspire the belief that the difficulties encountered by previous Arctic explorers would be avoided in a large measure. In this position he was sustained to some extent by the wonderful journey across Greenland performed by Dr. Fridjof Nansen. After passing the barriers of snow and ice on the coast, he hoped to travel over the snow plains of the interior without difficulty on the *skier* that served Dr. Nansen so well. After the expedition started it was discovered that he had taken too rosy a view of the prospect. His arrangements were not so complete as they should have been; so simple a matter as obtaining the co-operation of the Danish Government, and the assistance of the officials in Greenland, had been overlooked. When the party that accompanied him to Greenland returned, grave apprehension for the safety of himself and his companions was felt. And the feeling of apprehension becomes intensified when it is remembered that one of the persons thus subjected to unnecessary risks of suffering, starvation, and perhaps death among Arctic snow wilderness is a woman, Mr. Peary's brave wife."

— We learn from *Mind* that the second session of the International Congress of Experimental Psychology will be held in London, on Tuesday, Aug. 2, 1892, and the three following days, under the presidency of Professor Henry Sidgwick. Arrangements have already been made by which the main branches of contemporary psychological research will be represented. In addition to the chief lines of investigation comprising the general experimental study of psychical phenomena in the normal human mind, it is intended to bring into prominence such kindred departments of research as the neurological consideration of the cerebral conditions of mental processes; the study of the lower forms of mind in the infant, in the lower races of mankind, and in animals, together with the connected laws of heredity; also the pathology of mind and criminology. Certain aspects of recent hypnotic research will also be discussed, and reports will be given in of the results of the census of hallucinations which it was decided to carry out at the first session of the congress (Paris, 1889). Among those who have already promised to take part in the proceedings of the congress may be named the following: Professor Beaunis, Monsieur A. Binet, Professor Pierre Janet, Professor Th. Ribot, and Professor Richet (France); Professor Lombroso (Italy); Dr. Goldscheider, Dr. Hugo Münsterberg, Professor G. E. Müller, Professor W. Preyer, and Dr. Baron von Schrenk-Notzing (Germany); Professor Alfred Lehmann (Denmark); Professor N. Grote and Professor N. Lange (Russia); Dr. Donaldson, Professor W. James, and Professor Stanley Hall (United States of America); and Professor V. Horsley, Dr. Ch. Mercier, and Dr. G. J. Romanes (England). It is also hoped that Dr. A. Bain, Professor E. Hering, and others, may be able to take part in the proceedings; and that some, as Professor W. Wundt, who will not be able to attend the congress, may send papers. As a specimen of the work that will be done it may be said that Professor Beaunis will deal with Psychological Questioning; Monsieur Binet with some aspect of The Psychology of Insects; Dr. Donaldson with Laura Bridgman; Professor Stanley Hall with Recent Researches in the Psychology of the Skin; Professor Horsley with The Degree of Localization of Movements and Correlative Sensations; Professor Pierre Janet with Loss of Volitional Power; Professor N. Lange with Some Experiments and Theories concerning the Association of Ideas; Professor Lombroso with The Sensibility of Women, Normal, Insane, and Criminal; Dr. Münsterberg with Complex Feelings of Pleasure and Pain; and Professor Richet with The Future of Psychology. A committee of reception has been formed, which includes, among others, the following names: Dr. A. Bain, Dr. D. Ferrier, Mr. F. Galton, Dr. Shadworth Hodgson, Professor V. Horsley, Dr. Hughlings Jackson, Dr. Charles Mercier, Professor Croom Robertson, Dr. G. J. Romanes, Mr. Herbert Spencer, Mr.

G. F. Stout, Dr. J. Ward, and Dr. de Watteville. The fee for attendance at the congress is ten shillings. Arrangements will be made for the accommodation of foreign members of the congress at a moderate expense. Communications are invited, which should be sent to one of the honorary secretaries (F. W. H. Myers, Leckhampton House, Cambridge; or James Sully, East Heath Road, Hampstead, London, N.W.) not later than the end of June, and as much earlier than that date as possible. The communication should be accompanied by a *précis* of its contents for the use of members.

— In a recent number of the *Revue Médicale de la Suisse Romande*, Dr. Grandjean has related a case of very great interest. It is that of a man of thirty-four, who, with the exception of an attack of somnambulism at the age of eight — an attack in which he had walked into his father's bedroom and congratulated him on being elected king of Italy — had been previously healthy. Towards the end of January, 1890, he began to suffer from nightmare and depression, without apparent cause, but he had no headache or vomiting. This condition persisted for two weeks. Then, on Feb. 9, after going to his office and working as usual, at nine o'clock in the morning he took his hat, set out on foot, and arrived at Payerne, a village fifty kilometres distant. He had no recollection of anything that happened from the time he left his office until he awoke, in the middle of the night, in an inn at Payerne. His boots, he found, were much worn, but his clothes were in good order. He presented none of the usual effects of having passed through an epileptic paroxysm, except that he had a violent headache. After this he remained as usual for seven months, except that he had occasional "absences." Thus, on one occasion, while writing, he was surprised to find that he had continued at his work for an hour without any recollection of having done so. The work was done perfectly, without a single mistake. At the end of the seven months he had another attack similar to the first, but lasting for two days, during which he had gone about to different places acting in a manner which did not strike any observer as strange or peculiar, but being all the time unconscious. Five months later he had a similar, even more elaborate, attack, which also lasted for two days, and was followed by headache more violent than usual. Dr. Grandjean comes to the conclusion that this is undoubtedly a case of epileptic automatism. He does so from the nature of the attacks, from the fact that the man also suffered from "absences" of longer or shorter duration, really attacks of *petit mal*, and because the latter became almost totally suppressed under treatment by the bromides. The case is an important one, and it should serve to impress the fact once more that some criminals who profess complete unconsciousness of the act or acts with which they are charged may really be the subjects of epileptic automatism. If this patient had committed some crime during one of those periods of unconsciousness, a defence to the effect that he was the subject of epilepsy would have been received with considerable doubt, especially as there was nothing in the nature of a severe fit to point to in the former history, but only those temporary "absences" without any obvious convulsion.

— At the meeting of the Chemical Society of Washington, Jan. 14, Professor H. W. Wiley presented a paper on "Midzu-ame." The sample of midzu-ame or Japanese glucose analyzed by Professor Wiley was brought to the laboratory of the Agricultural Department by Dr. W. St. George Elliot, having been sent to him from Yokohama by Mr. J. H. Loomis. A sample of heavy confectioner's glucose was analyzed at the same time and the two compared. The characteristic of the midzu-ame is its high percentage of maltose, nearly all of the reducing sugar present being maltose. The ash of the midzu-ame contained only a trace of sulphates, no lime, no chlorium, and was strongly alkaline. The ash of the confectioner's glucose contained large quantities of sulphates, very little lime, and was also alkaline. The pleasant flavor of the midzu-ame seems to render it preferable to glucose for confectioners' use, and Professor Wiley thought it may be destined to have an important future in this respect. He referred to its use in Japan, where it has been used for medical purposes with dialyzed iron and cod liver oil. Its only advantage over maltine is its easy digestibility. Professor Wiley also described the methods of manufacture in Japan as given by Dr. J. C. Berry and by Mr. Loomis. W. F. Hillebrand, in his paper on "Zinc-bearing Spring Waters from Missouri," described the springs as issuing from a low bluff a few miles south-west of Joplin, and their chief constituent as zinc sulphate, amounting to three hundred parts per million in a total weight of less than twice that amount of salts. Cadmium, lead, and copper were found in small quantity, and the other constituents were sulphates of calcium, magnesium, sodium, potassium, manganese, aluminium, and iron; also calcium carbonate, silica, and a small amount of sodium chloride.

— Professor Albert A. Michelson of Clark University has been invited by the International Bureau of Weights and Measures to spend the coming summer at the Bureau's laboratory at Breteuil, near Paris, for the purpose of establishing a metric standard in terms of wave lengths of light. Of the three methods of determining a standard of length, the measuring a quadrant of the earth's circumference, the oscillation of a pendulum under given conditions, and the length of light waves at a given line in the spectrum, the last is the most accurate and has the advantage of being a cosmic rather than terrestrial standard. In his original paper explaining the method, Professor Michelson had the co-operation of Professor Morley of Cleveland. The invitation of the International Committee has been accepted by Professor Michelson with the informal approval of the president and trustees of Clark University. Their formal action in granting him leave of absence only awaits the arrival of official papers from Paris and Berlin. The order for the additional new apparatus has been placed with the American Watch and Tool Company of Waltham and with Mr. Brashier of Pittsburg. The working drawings have been made by F. L. C. Wardwell. Professor B. A. Gould of Cambridge, the well-known astronomer and American representative of the International Congress of Weights and Measures, writes to President Hall as follows: "The proposed investigation is a magnificent one, audacious, yet already proved by Professor Michelson to be feasible. The honor inuring to our country by the selection of an American professor to carry it out and an American artist for constructing an apparatus requiring such surpassing delicacy is one which, I am confident, you will appreciate as highly as I do. It is my conviction that the assent of Clark University will not only redound to its high honor and be gratefully recognized throughout the civilized world, but will constitute an enduring title to remembrance and full appreciation in the history of science. It seems to me a just source of pride that our country should be called on to take the chief part, both scientific and technical, in such an undertaking, and I will not deny that I am considerably elated by it." Telegrams from Professor Foerster at Berlin and Hirsch of Switzerland, president and secretary, respectively, of the International Bureau, have been received, ratifying all arrangements.

— The Indiana Academy of Science held its annual meeting in the Capitol at Indianapolis, Dec. 30 and 31, 1891, under the presidency of Professor O. P. Hay of Butler University, Irvington, Ind. Owing to the great number of papers entered, it was necessary, throughout the most of the meeting, to meet in two sections: Section A., zoology, botany, and geology; Section B., chemistry, physics, and mathematics. On Wednesday morning and evening general sessions were held. At the latter the president's address on "The Present State of the Theory of Organic Evolution" was delivered. There were ninety-eight papers entered, and under the rules none were permitted on the programme except such as were expected to be read. The committee appointed at the summer meeting of the Academy, at Lake Maxincuckee, to consider the question of science work in the high schools of the State reported that it had brought the subject to the attention of the State Board of Education, with the result that the presidents of Purdue University and Indiana University were appointed a committee to prepare a circular of instruction, to be distributed by the board to high schools and to school officers. The circular is nearly ready for distribution. The committee appointed to secure the passage by the legislature of an act to protect native birds reported

that such legislation had been secured. The following papers were presented: Some Suggestions to Teachers of Science or Mathematics in High Schools, by T. C. Van Nuys; Notes on Numerical Radices, by C. A. Waldo; The Kankakee and Pure Water for North-western Indiana and Chicago, by J. L. Campbell; Biological Surveys, by John M. Coulter; The Distribution of Tropical Ferns in Peninsular Florida, by L. M. Underwood; Unused Forest Resources, by Stanley Coulter; Preliminary Notes on the Geology of Dearborn County, Ind., by A. J. Bigney; Jefferson County Cystidians, Hudson River Fossils of Jefferson County, Ind., and The Upper Limit of the Lower Silurian at Madison, Ind., by George C. Hubbard; Variations in the Dynamical Conditions During the Deposit of the Rock Beds at Richmond, Ind. (by title), by Joseph Moore; The Relation of the Keokuk Groups of Montgomery County with the Typical Locality, and Comments on the Description of Species, by C. S. Beachler; On a Deposit of Vertebrate Fossils in Colorado by Amos W. Butler; Topographical Evidence of a Great and Sudden Diminution of the Ancient Water Supply of the Wabash River (by title), and Source of Supply to Medial Moraines Probably from the Bottom of the Glacial Channel (by title), by J. T. Campbell; Notes on a Kansas Species of Buckeye, by W. A. Kellerman; On the Occurrence of Certain Western Plants near Columbus, Ohio, by Aug. D. Selby; Preliminary Notes on the Genus Hoffmanseggia, by E. M. Fisher; Preliminary Paper on the Flora of Henry County, Ind. (by title), by T. B. Redding and Mrs. Rosa Redding Mikels; A New Microtome, by George C. Hubbard; Notes on the Organogeny of the Compositæ (by title) by G. W. Martin; Notes on the Development of the Archegonium and Fertilization in Tsuga Canadensis and Pinus Sylvestris, by D. M. Mottier; Strange Development of Stomata upon Carya Alba Caused by Phylloxera, by D. A. Owen; Development of the Sporangium and Apical Growth of Stem of Botrychium Virginianum, by C. L. Holtzman; The Flora of Mount Orizaba, by H. E. Seaton; An Apparatus for Determining the Periodicity of Root Pressure, by M. B. Thomas; Condensation of Acetophenone with Ketols by Means of Dilute Potassium Cyanide, Condensation of Acetone with Benzoin by Means of Dilute Potassium Cyanide, and Pyrone and Pyridone Derivatives from Benzoyl Acetone, by Alexander Smith; Carbonic Acid in the Urine, by T. C. Van Nuys and R. E. Lyons; Results of Estimations of Chlorine in Mineral Waters, by Volhardt's Method, by Sherman Davis; The Sugar Beet in Indiana, and Forms of Nitrogen for Wheat, by H. A. Huston; A Copper Ammonium Oxide, by P. S. Baker; Di-benzyl Carbinamine, and The Character of Well Waters in a Thickly Populated Area, by W. A. Noyes; Laboratory and Field Work on the Phosphate of Alumina, by H. A. Huston; Recent Archæological Discoveries in Southern Ohio, by Warren K. Moorehead; Photographing Certain Natural Objects without a Camera, by W. A. Kellerman; Recent Methods for the Determination of Phosphoric Acid, by H. A. Huston; The Digestibility of the Pentose Carbohydrates (by title), and The Action of Phenyl-Hydrazin on Furfurol (by title), by W. E. Stone; A Graphical Solution of Equations of Higher Degree for both Real and Imaginary Roots, and On Some Theorems of Integrations in Quaternions, by A. S Hathaway; The Section of the Anchor Ring, by W. V. Brown; A Note on the Early History of Potential Functions, by A. S. Hathaway; Some Geometrical Propositions, by C. A. Waldo; Some Suggested Changes in Notation, by R. L. Green; An Adjustment for the Control Magnet on a Mirror Galvanometer, and A Combined Wheatstone's Bridge and Potentiometer, by J. P. Naylor; Hysteresis Curves for Mitis and Other Cast Iron, by J. E. Moore and E. M. Tingley; Heating of a Dielectric in a Condenser (preliminary note), by Albert P. Carman; Science and the Columbian Exposition, by J. L Campbell; Exploration of Mount Orizaba, by J. T. Scovell; Entomologizing in Mexico, by W. S. Blatchley; Distribution of Certain Forest Trees (by title), and Cleistogamy in Polygonium (by title), by Stanley Coulter; The Cactus Flora of the South-west (by title), by W. H. Evans; Methods Observed in Archæological Research (by title), by Warren K. Moorehead; The Prehistoric Earthworks of Henry County, Ind. (by title), by T. B. Redding; A Review of the Holconotidæ, by A. B. Ulrey; Some Additions to the State Flora from Putnam County, and Connecting Forms Among the Polyporoid Fungi, by L. M. Underwood; On LeConte's Terrapins, Emys concinna, and E. floridana (by title), The Eggs and Young of Certain Snakes, and Observations on the Turtles of the Genus Malochlemys (by title), by O. P. Hay; The Gryllidæ of Indiana, by W. S. Blatchley; The Outlook in the Warfare Against Infection (by title), by Theodore Potter; Our Present Knowledge Concerning the Green Triton, and The Proper Systematic Name of the Prairie Rattlesnake, by O. P. Hay; The Blind Crayfishes of Indiana, and Remarks on the Crustaceans of Indiana, by W. P. Hay; Notes on Elaps fulvus, by A. J. Bigney; Some Observations on Heloderma Suspectum, by D. A. Owen; Some Observations on Photomicrography, by D. W. Dennis; Diseases of the Sugar Beet Root, by Miss Katherine E. Golden; Buffalo Gnats (Simulium) in Indiana and Illinois, by F. M. Webster; The Development of the Viviparous Fishes of California (by title), and Recent Additions to the Icthyological Fauna of California (by title), by Carl H. Eigenmann; Some Observations on Indiana Birds, by R. Wes McBride; On Indiana Shrews, and Notes on Indiana Birds, by Amos W. Butler; The Scales of Lepidoptera, by M. B. Thomas; The Ægeria of Central Ohio, by D. S. Kellicott; Some Insects of Tasmania, and Early Published References to Injurious Insects (by title), by F. M. Webster; The Continuity of the Germ Plasm in Vertebrates (by title), Biological Stations (by title), The Eyes of Blind Fishes (by title), and On the Presence of an Operculum in the Aspredinidæ (by title), by Carl H. Eigenmann; Notes on Indiana Aididæ (description of one new species), by W. S. Blatchley; The Relation of Neucleaplasm to Cytoplasm in the Segmenting Egg (by title), by C. H. Eigenmann and R. L. Green; Plant Zones of Arizona (by title), by D. T. McDougal; Relation of Available Enzym in the Seed to Growth of the Plant, and The Potato Tuber as a Means of Transmitting Energy, by J. C. Arthur; Contributions to a Knowledge of the Grain Toxoptera (Toxoptera graminum) (by title), by F. M. Webster. A committee was appointed to arrange for publishing the proceedings of this meeting. Twenty active members were elected.

— The College of Physicians of Philadelphia announces that the next award of the Alvarenga prize, being the income for one year of the bequest of the late Señor Alvarenga, and amounting to about one hundred and eighty dollars, will be made on July 14, 1892. Essays intended for competition may be upon any subject in medicine, and must be received by the secretary of the college on or before May 1, 1892. It is a condition of competition that the successful essay or a copy of it shall remain in possession of the college.

— A complete series of soundings has been taken over the whole bed of the Lake of Geneva, and a report is given in *Cosmos*, Vol, X. No. 9, by the engineer, M. A. Delebecque. The length of the lake is 45 miles and its greatest breadth 8½ miles. Its area is 223 square miles, and the height of its surface above sea-level about 1,230 feet. The bed of the lake is divided into two distinct parts, the Great Lake between Yvoire and Villeneuve, and the Little Lake between Yvoire and Geneva. The bottom of the Great Lake is nearly level over an area of 17¼ square miles, and lies at a depth of 169 fathoms. The slopes are more sudden at the eastern end, where the mountains descend more precipitously to the water, the inclination being 48 degrees between Saint-Gingolph and Bouveret, and 56 opposite the Castle of Chillon. The River Rhone has made a deep channel, lined with dykes, in the bottom of the lake. This channel extends in a tortuous course for a distance of 3½ miles from the mouth of the river. Near its commencement it has a depth of 190 feet, and beyond Saint-Gingolph it is still 30 feet deep, where the depth of the lake is 109 fathoms. Its formation is due to the large quantities of alluvium brought down by the Rhone, and to the lower temperature of its waters, which causes them to flow under the waters of the lake. The Dranse, which brings down gravel and stones, as well as mud, to the lake, has formed what is known as a *torrential* delta at its mouth, in the form of a cone, continually advancing further and further into the lake. The Little Lake consists of four depressions, separated by bars of small elevation, projecting from the points of Nernier, Messery, Hermance, and Bellerive. The depths of these basins are 249, 239, 229, and 164 feet, respectively. At the bottom of this portion of the lake are to be found traces of the passage of the ancient Rhone glacier which extended to Lyons.

The bar of Nernier, or at least its upper surface, has at one time formed part of a moraine. A bathymetrical map accompanies the article from which this note is taken.

— Mr. Edgar Richards, who, for the past four and a half years, has been in charge of the chemical laboratory connected with the Internal Revenue Bureau at Washington, D.C., having been peremptorily directed by his physician, Dr. F. Delafield of this city, to abstain from all work for some months in the department, has been forced to resign his position, as the Commissioner of Internal Revenue refused to grant him leave of absence in which to rest. Thus the government loses an efficient and faithful officer. Mr. Richards sails on the 23d of January, by the "Werra," for southern Europe, where he will remain for several months before returning to this country.

— From some further surface and bottom temperatures recently taken by Commander Boulton, R.N., in Lake Huron, A. T. Drummond, in this month's *Record of Science*, concludes that the Georgian Bay forms a great cold water basin, somewhat isolated, not only by its physical surroundings but in the temperature of its water, from the central basin of the lake; that the temperature of its bottom does not, even in summer, rise beyond about 39.2°; and that the flow of cold water from Lake Superior into Lake Huron is divided by the position of the islands in the St. Mary's River and along the north shore of Lake Huron, a part flowing to the Georgian Bay by the north channel, between the Manitoulin Islands and the north shore of the lake, thus keeping up the supply of cold water, whilst another part passes through the Detour and the neighboring channels into the central basin of the lake, but instead of mingling there with the warmer waters from Lake Michigan, appears to flow easterly and south-easterly, forming a barrier to the easterly extention of these warmer Michigan waters, and cutting off the Georgian Bay from their influence. In the same journal, Mr. Drummond also refers to a series of temperatures taken by him during last August in the Yamaska River, Province of Quebec, in order to trace the extent of the influence which water temperatures have upon the surrounding air, and, inferentially — in the case of large bodies of water — upon the agricultural capabilities of the neighboring land. The tests were not sufficiently varied as to time and place to, as yet, warrant definite conclusions, but it can be said in general terms that such rivers, which in winter, in the Canadian climate, are paved with two or more feet of ice, have, in the early days of August, a temperature of 76° to 77° F.; that the air in direct contact with the warm surface of the water has in that month its temperature raised to from 1° to 5° above that of the air directly above, but in more exposed positions; and that this increase of temperature, which is greatest at the point of contact, is at one foot above the surface already to a considerable extent lost.

— Harper & Brothers announce a new and revised edition of Autenrieth's valuable "Homeric Dictionary," translated by Professor Robert P. Keep. The present revision has been performed by Professor Isaac Flagg of the University of California, whose name alone is a guarantee of its excellence. Almost every American Greek scholar of reputation has also aided in the work by suggesting corrections or helpful additions, and no effort has been spared to adapt the volume perfectly to the needs of American and English students. Several important changes of considerable value have also been made. They will publish shortly in the Queen's Prime Ministers series "The Marquis of Salisbury," by H. D. Traill.

— A volume entitled "The Dog in Health and in Disease," by Dr. Wesley Mills, and published by D. Appleton & Co., discusses in detail the history of all the varieties of dogs, their breeding, education, and general management in health, and treatment in disease. The book is adapted for both the veterinarian, to whom the medical care of dogs is usually confided, and the general reader whose interest may be limited to that involved in the ownership of a single animal. The writer is professor of physiology in the faculty of Veterinary Science of McGill University, Montreal, the author of "Comparative Physiology" and other standard works on allied topics; and is further qualified for his task by the fact that he has, as he states in his preface, "for the greater part of his life studied this noble animal with pleasure and profit to his own nature." The volume contains a large number of illustrations related to the text, and is further embellished by portraits of various dogs of note of many breeds.

— Charles Scribner's Sons announce that the first two volumes to be published in the Great Educators Series will be "Aristotle, and the Ancient Educational Ideals," by Thomas Davidson, and "Loyola, and the Educational System of the Jesuits," by the Rev. Thomas Hughes of Detroit College. The next volume, the fifth, in the University Extension Manuals will be "French Literature," by H. G. Keene of Oxford. They have just published "Ten Centuries of Toilette," translated from the French of A. Robida by Mrs. Cashel Hoey, and uniquely illustrated in colors and in black and white by the author. The unexpected delay in the publication of Edward Whymper's "Travels Amongst the Great Andes of the Equator" has been due to the unusual care and thoroughness with which the author is revising the proofs before allowing the book to go to press. It is thought, however, that the book will be ready for publication in a few weeks.

— Longmans, Green, & Co. are about to publish a new work in two volumes on "The Human Mind," by James Sully, of which the author says in a communication to *Mind*: "The present work is an expansion and further elaboration of the doctrine set forth in the author's 'Outlines of Psychology.' Although the mode of arrangement and of treatment will in the main be found to be similar, the book may be described as a new and independent publication. It is specially intended for those who desire a fuller presentment of the latest results of psychological research than was possible in a volume which aimed at being elementary and practical. Hence much more space has been given to the new developments of 'physiological' and experimental psychology, to illustrations of psychological principles in the phenomena of racial and animal life, of insanity and hypnotism. At the same time, an effort has been made to illustrate the obscurity and debatableness of many of the problems of the science, and to aid the reader in arriving at a judicial conclusion on these points by historical references to the main diversities of doctrine. In this way it is hoped that the treatise will find its proper place beside the 'Outlines.'"

— D. Appleton & Co. will publish immediately the third volume of Professor J. B. McMaster's "History of the People of the United States." The second volume closed with the negotiations regarding the Louisiana purchase. In the new volume, which contains ten chapters, Professor McMaster begins with the discussion regarding the constitutionality of the Louisiana purchase. The first chapter includes a careful presentation of the manners, customs, and special characteristics of the people of New Orleans, and the connection of the New England leaders and of Burr with the Louisiana question. The second chapter treats of the results of the Louisiana purchase, the conspiracy of Aaron Burr, his expedition in the Ohio Valley, and his arrest and trial. The third chapter is devoted to the conduct of the public lands from 1776 to the establishment of the Territories of Illinois and Michigan. The fourth chapter, entitled "The Spread of Democracy," describes the extension of the franchise, the relations of the people and the judiciary, and the presidential campaign of 1804. The fifth chapter, which has for its heading the old cry of "Free Trade and Sailors' Rights," is principally devoted to foreign relations, from the Barbary War to the passage of the embargo. The sixth chapter treats of the "Long Embargo," and closes with the inauguration of Madison. After a chapter on subsequent events, called "Drifting into War," the author pauses for a description of the progress of the people since 1784, showing the changes, political, economical, and social, the development of means of communication, the building up of manufactures, the arguments for protection, the relations of the people to the slavery question, and the Seminole War. In the closing chapter the author pictures the preparations for the War of 1812 and its disastrous opening, with the surrender of Hull at Detroit The volume contains two maps, an index, and an elaborate table of contents.

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FORTY YEARS OF WHEAT CULTURE IN OHIO.[1]

Ohio lies within the borders of what is known as the winter wheat belt of the United States — a region, the soil and climate of which are especially adapted to the culture of this cereal. The State possesses two great natural arteries of traffic, one on its northern and one on its southern boundary, and before the advent of the railway it was crossed by two lines of canals, each extending from the lake on the north to the river on the south, and affording outlets for its productions that served a very important function in its early history. Lying, as it does, right in the gateway between the East and the West, it has been crossed by line after line of the great transcontinental railways, while its rich mineral resources have caused the building of multitudes of other lines, running in all directions, until its territory is now traversed by a network of railways, aggregating within the State nearly 8,000 miles of main track, besides more than 2,000 miles of sidings.

Under such circumstances it is not surprising that the culture of wheat became at an early date, and has ever continued to be, a leading branch of Ohio's agriculture, and that the State should not only have liberally supplied itself with bread, but have had much to spare.

Because of this relative prominence of wheat culture in the agriculture of the State, the Experiment Station has made the study of wheat a leading feature of its work, and the statistical study now published has been undertaken primarily for the purpose of obtaining such assistance as it might give in the conduct of the station's experimental research. It was hoped that this study might throw some light upon such problems as the relative adaptability to wheat culture of soils of different geologic origin and history, and the effect of differences of latitude, of drainage, and the use of commercial fertilizers, and it is believed that some of the conclusions which it seems to warrant should be carefully considered by the farmers of large areas of the State.

[1] From the Bulletin of the Ohio Agricultural Experiment Station, Nov., 1891.

A glance at the geological map of Ohio shows three broad bands running across the State from north to south. That on the east embraces the coal measures, and extends across nearly one-third of the State; then follows a narrower strip, underlaid with Waverly rocks and bordered by a narrow belt of Huron Shales, while the western half of the State lies over limestones.

As the Waverly rocks are chiefly sandstones or calcareous shales, this formation would offer a sharp contrast between soils of such origin and those derived from limestones, were it not for the fact that, in the case of Ohio, both these formations are covered with a thick bed of glacial drift. The drift, however, is considerably modified by the underlying rocks, and it would seem that if there were any marked differences in the value for wheat culture of soils of the widely different character produced from these different formations it should be indicated in this case.

Omitting the four counties in the north-western corner of the State, which overlie the outcrop of Huron shale in that region, viz.: Williams, Fulton, Defiance, and Henry; the five counties which lie on both sides of the belt of Huron shale, extending north and south through the State, namely: Erie, Crawford, Delaware, Franklin, and Pickaway, and the five counties lying immediately north of the coal region and chiefly over conglomerates, namely: Lake, Geauga, Ashtabula, Summit, and Trumbull, the remaining seventy-four counties have been divided into three parallel belts, according to latitude, and subdivided according as they lie over the limestones, shales, or coal measures, making nine groups in all.

In the northern belt are included twelve limestone counties, viz.: Lucas, Ottawa, Wood, Sandusky, Paulding, Putnam, Hancock, Seneca, Van Wert, Allen, Hardin, and Wyandot; seven counties over the Waverly, viz.: Lorain, Cuyahoga, Huron, Medina, Richland, Ashland, and Wayne, and six counties over coal, viz.: Portage, Mahoning, Stark, Columbiana, Holmes, and Carroll.

In the middle belt are eleven limestone counties, viz.: Mercer, Auglaize, Marion, Shelby, Logan, Union, Darke, Miami, Champaign, Clark, and Madison; four Waverly counties, viz.: Morrow, Knox, Licking, and Fairfield, and seven coal counties, viz.: Coshocton, Tuscarawas, Harrison, Jefferson, Muskingum, Guernsey, and Belmont.

In the southern belt are twelve limestone counties, viz.: Preble, Montgomery, Greene, Fayette, Butler, Warren, Clinton, Highland, Hamilton, Clermont, Brown, and Adams; three Waverly counties, viz.: Ross, Pike, and Scioto, and twelve coal counties, viz.: Perry, Morgan, Noble, Monroe, Hocking, Athens, Washington, Vinton, Meigs, Jackson, Gallia, and Lawrence.

It appears that in the northern belt the counties over Waverly rocks have given a larger average yield over the entire forty-year period under review than those in the same latitude, which are underlaid with limestones or with the rocks of the coal measures, and that the rate of increase in yield during the past twenty years is also larger in the counties over the Waverly.

In the middle belt the result is just the opposite: the limestone counties show the larger yield and the greater rate of increase.

In the southern belt the limestone counties show the larger yield, but the Waverly counties show a greater rate of increase.

The counties overlying the coal measures stand below either of the other divisions in yield per acre in each of the

belts, the difference increasing in the more southerly latitudes. In rate of increase they stand between the other two divisions. The topography of these hilly, coal counties is a sufficient cause for their lower yield, and is probably the chief cause, as the rocks of the coal measures comprise both limestones and shales, and it is probable that the soils derived from them are not naturally inferior in fertility to those found in the remainder of the State.

As between the soils lying over limestones and those over shales, these statistics do not yet justify any opinion regarding their respective adaptation to the production of wheat. It is probable, however, that the middle and southern belts of counties afford a more just basis of comparison between the two geological formations than the northern belt, because in this northern region the overlying drift has been derived, to a large extent, from the rocks excavated from the lake basin, and which are both limestones and shales.

Within twenty years the area annually sown to wheat in Ohio has increased from an average of 1,800,000 acres during the eighth, to 2,500,000 acres during the ninth decade. This area represents twelve per cent of the area in farms within the State, but several counties are sowing annually 18 to 20 and even 25 per cent of their farm lands to wheat. In 1881 a total area of 2,800,000 acres was sown, and there is no good reason to doubt that with the continued clearing away of the forest and the reclamation of waste lands by drainage it will soon be possible to devote as much as 3,000,000 acres to wheat without infringing upon any other agricultural interest, and this, even though the hill counties should reduce their acreage by one-half. Such an increase, at the present rate of production, would represent an annual product of 40,000,000 bushels.[1]

But it is not to be supposed that Ohio farmers will rest content with a yield of only thirteen bushels of wheat per acre. The northern third of the State has increased its average yield within forty years by nearly three bushels, and the middle third by from one to two bushels, and it is reasonable to expect a similar increase within the next forty years, notwithstanding the fact that the rate of production seems just now to be at a standstill. It is to be expected that progress in this, as in other matters, will be more or less spasmodic, and that its actual rate can only be measured at long intervals; but it is not impossible that the time may come when the average from the entire State will equal the present average of Summit county, which means a total average production of about 60,000,000 bushels, or bread for twelve million mouths. Such a yield would be far below what has been attained in Great Britain, where the average yield is now 28 bushels or more per acre and is steadily increasing. This high yield is not due solely to the superiority of the soil and climate of that country, for the time has been when the average yield of Great Britain was very much smaller than it is at present.

Ohio's population has increased by a little more than two millions since 1850, while the total wheat yield has increased by an average of more than 14,000,000 bushels per annum, comparing the average of the first decade with that of the decade 1850–9, so that production is keeping far ahead of any possible consumption within the State. Production will eventually reach a limit, while population may expand indefinitely, but at present rates of increase, both of population and of wheat production, it will probably be several centuries before Ohio shall contain enough people to consume all her wheat.

[1] 48,000,000 bushels were harvested in Ohio in 1888.

What is true of Ohio is true to a greater or less extent of the entire winter wheat belt of North America. The area now sown to wheat in this region may be expanded largely without infringing upon other productions, and the rate of yield may and will be very materially increased by better husbandry, including an intelligent use of manures and fertilizers, and more thorough drainage.

Let there be given a little stimulus in the shape of higher prices for wheat and we shall see a rapid expansion in the total production in this country, while there are still undeveloped regions in South America, south Africa, and Australia, which will eventually be made to add largely to the world's supply of breadstuffs.

This is not said by way of discouragement. I believe that the future outlook for the Ohio wheat grower is eminently a hopeful one, but I do not expect to see the very great increase in price of wheat that is being predicted by certain statistical writers. In my judgment, the great opportunity for the Ohio wheat grower lies in increasing the yield per acre, in reducing the cost of production, and in improving the quality of the grain. Such a course will render him independent of the market, and then if higher prices do come he will be doubly benefited.

It appears from this statistical study of the wheat harvests of Ohio that the average yield of wheat is increasing in the northern and central sections of the State, while it is at a standstill, and standing at far too low a point for profit, in the southern and south-eastern counties.

It would seem that the profitable culture of wheat on the steep hillsides of southern Ohio is a hopeless undertaking; that the great problem before the wheat grower of the central belt of counties is winter-killing, a problem which may be partially solved by underdrainage and the intelligent use of clover and manures; and that in the northern counties climatic influences are more generally favorable to wheat culture than elsewhere in the State.

The statistics indicate that the wheat crops of Ohio have been slightly increased by the use of commercial fertilizers, but it appears that the average cost of this increase has equaled its market value, and that a general improvement in the methods of agriculture has contributed more largely to the increase of Ohio's wheat crops than the use of purchased fertility.

It would seem that the total area under wheat might be considerably enlarged, and at the same time more closely restricted to lands adapted to tillage, and that the yield per acre may be so increased that the total product shall reach double the quantity now annually produced.

CHAS. E. THORNE.

THE ANTHROPOLOGY OF EUROPE.

"THE Anthropology of Europe" was the title of a course of lectures (the Rhind lectures) delivered in Edinburgh last October by Dr. Beddoe, ex-president of the Anthropological Institute of Great Britain, of which we find the following brief abstract in the *Scottish Geographical Magazine:* Dr. Beddoe, in his earlier lectures, dwelt chiefly on some of the problems of anthropology, briefly on the question of priority of dolichocephalic or brachycephalic types, briefly also on the great Aryan question, and at greater length on that of the influence of environment, towards modifying of types, to which he repeatedly referred during subsequent lectures. He noted the very frequent occurrence of broad, even very broad, skulls in conjunction with very narrow ones in some of the earlier, if not the earliest, "finds," a circumstance not

yet sufficiently explained. He showed that we knew very much more about the succession of races and the details of ethnography, where these related to western Europe, especially to France, because these parts were inhabited, owing to the geological conditions, earlier than the north-eastern portions of Europe, while in the east and south-east generally, and in Spain, anthropological science was not sufficiently advanced, or political circumstances intervened, and investigators were few. With respect to the Aryan question, he pronounced no very decided opinion, though he spoke of certain doctrines on the original habitat as the Scandinavian and Lithuanian heresies; and he showed some inclination towards that view which looks on the Galchas as representing the ancestors of the Iranians and of the people who brought the Aryan languages into Europe, in which case the brachycephals of the central mountain chains, the Carpathians with the Balkans, Bohemian Mountains, the Alps, Jura, Vosges, Cevennes, etc., may be looked on as retaining much of the original Aryan blood, seeing that their physical characteristics have a general resemblance to those of the Galchas. He discredited the argument that because the Aryan-speaking inhabitants of Europe were more numerous than those of Asia, it was much more easy to derive the latter from the former, the less from the greater, than *vice versa*, remarking that on the same principle we should derive the English from North America and the Portuguese from Brazil, and that it was not at all unlikely that about the dawn of history, when Asia was thickly and Europe comparatively thinly peopled, the proportions were quite different, especially as at that time the Iberians were still unorganized as to language. With regard to the influence of environment he quoted Kollmann of Basel's five types: —

1. Long-headed long-faced, the Grave-row or Germanic, etc.,
2. Broad-headed long-faced, the Disentis or Sarmatic,
3. Long-headed broad-faced, the Cro-Magnon,
4. Broad-headed broad-faced, the Turanian,
5. Mesocephalic broad-faced,

but said he thought the types too few and the limits too absolute and precise as to figures.

He showed the extreme divergence of views on this subject of environment, — noting how Kollmann denied any change of types, or material progression therein, since the period when we knew anything of man in Europe, saying that man was fit for anything when he first appeared here, and that for the establishment of permanent varieties we must look further back, perhaps even into the Miocene age.

On the other hand, Schaaffhausen, Ranke, and, to a less decided extent, perhaps Virchow himself, assign very great importance to environment. The first indicates a large number of points of inferiority as occurring together or separately in the old dolichocephals, and believes that in Germany, if not elsewhere, heads are gradually growing broader with increasing intelligence and civilization, while Ranke thinks that in Bavaria, in some unexplained way, the inhabitation of mountain regions has a tendency to broaden and shorten the head, and that, where race concurs with environment, as as in the once-slavonic hill-country of Upper Franconia, the tendency is still more marked, as from a double influence. Dr. Beddoe then went briefly through the history of the successive expansions and "swarmings" or migrations of the several races who have successively been active in Europe,— the Phœnicians, the Greeks, the Gallo-Kelts, the Romans, the Germans, the Slavs, the Saracens, and the Turco-Tartar tribes, and their share in modifying race-distribution.

Proceeding to consider the history and ethnology of Russia, he stated his opinion that the Scythians, if not altogether Turanian, were a mixed race into which a Turanian element entered, and who ruled over other tribes of different descent from themselves. The ancient skulls had not been found or preserved in great number, but they were almost all long, up to the Slavonic period, when they became rather broad, very much what they are at the present day. The Merians around Moscow were a Finnish tribe, who about the tenth or eleventh century were being subdued or incorporated by the encroaching Muscovites, and who finally disappeared; they were tall and strong, but pacific in habits, and, though they had commerce with the Arabs and Bulgarians, were comparatively poor. The history of Russia was one of gradual absorption of Finnish tribes, interrupted for a long period by the great invasion and domination of the Mongols of the Golden Horde. The numerous Finnish tribes seemed to have something common in their physiognomy, but differed very much in their indices of head-breadth, and also to some extent in complexion, some having dark hair, others to a large extent fair or brown, and some a large percentage of red hair, e.g., the Votiaks and Voguls, who are incorrectly said to be all red-haired.

Dr. Beddoe thought the Illyrians probably furnished the principal source of the black-haired folk in the Balkan Peninsula; they were also broad-headed. He entered into some details as to the changes in the Greek type and the history of the Thracians, as well as of the colonization of Bulgaria by the people who now bear that name.

With regard to Scandinavia he quoted the discrepant views of Montelius and Aspelin, the former doubting or denying the arrival of any new race since the neolithic period, the latter tracing the true Swedes to the Rhoxalani (Red-men in Finnish), whom he supposed to have entered Sweden about the fourth or fifth century.

In treating of Germany he entered pretty fully into the question of the change which appears to have taken place in the physique of the Bavarians and Swabians since the Marcomanni and Alemanni occupied these countries, quoting the different opinions of Von Hölder and Ranke on the subject, and especially the investigations of the former at Ratisbon.

In France and Belgium the clearest and most conclusive mass of anthropological fact was supplied by the investigations of Vanderhindere and Houzé into the color, head-form, stature, etc., of the Belgians. A line drawn east and west between the Flemings and the Brabanters and the Walloons separated two races differing in language, color, stature, head-form, and length of nose, and that in the sharpest manner. In France Dr. Beddoe also mentioned the inquiries of Broca and Boudin into stature, of Topinard into color, and of Collignon into head-form, and their remarkable results; and in Spain those of Don Telesforo de Aranzadi y Unamono, into the physical characteristics of the Guipuzcoan Basques, whom he believed not to be a pure race, but a mixture of three distinct elements. In Italy he showed how the stature and the head-breadth decreased gradually from north to south, and how the Sards were probably the purest breed in Europe, and the best representatives of the Mediterranean or southern race; also how closely the modern seemed to resemble the ancient Romans. In Britain he selected for special remark Pembrokeshire and the Isle of Man, and analyzed the indications of stature, color, and head-form in the Manxmen, who were a cross-breed between the Gael and the Norseman in all these respects. In Scotland he selected for special remark the people of Berwickshire and of Ballachu-

lish, showing that, though not very dissimilar in head-form, they were strongly distinguished in color of hair. He expressed his belief in the presence of a Finnish or Ugrian element in the population of Scotland, which was also found in Wales, and was marked among other characteristics by oblique eyes. The Iberian element, which had doubtless been strong among the Picts, continued to be so in many parts of Scotland, for example, in Wigtownshire and the upper part of Aberdeenshire, and in a great part of the Highlands.

The concluding part of the last lecture was devoted to an appreciation of the three (or, counting the Finns, four) great races which now divide Europe, of which the central, Alpine, brown, thick-set, broad-headed race seems the one most likely to spread at the expense of its neighbors. The question of race *versus* environment was also summed up, to the advantage, on the whole, of the former.

THE ABORIGINAL NORTH AMERICAN TEA.[1]

THERE is a shrub or small tree, a species of holly (Ilex cassine), growing in the Southern States along the seacoast, not extending inland more than twenty or thirty miles, from Virginia to the Rio Grande. Its leaves and tender branches were once used by the aboriginal tribes of the United States in the same manner as the Chinese use tea and the South Americans use maté. But while the use of *Thea sinensis* and *Ilex paraguayensis* still survives, the use of the shrub above mentioned has been almost abandoned by our native Indians and by the white people who once partially adopted it as a beverage.

The reason for its disuse is hard to discover, for, in common with tea and maté, it contains caffeine, or a similar alkaloid. The object of this paper is to examine its history, to suggest its restoration to a place among the stimulant beverages, and to inquire into its possible economic value.

I have been able to trace its use as a beverage back to the legendary migration of the Creeks from their supposed far western home to the seacoast of the Carolinas. Whether it was used by the prehistoric mound builders is a question which may not at present be solved. But some archæologist of the future may find in the remains of the mound-builders or their predecessors proof of its use among them.[2]

The leaves and young tender branches were carefully picked. The fresh cassine was gathered at the time of harvest or maturity of the fruits, which was their New Year. The New Year began with the "busk," which was celebrated in July or August, "at the beginning of the first new moon in which their corn became full eared," says Adair. The leaves were dried in the sun or shade and afterwards roasted. The process seems to have been similar to that adopted for tea and coffee. The roasting was done in ovens, remains of which are found in the Cherokee region, or in large shallow pots or pans of earthenware, such as the Indian tribes made.

These roasted leaves were kept in baskets in a dry place until needed for use. Loudonniere (1564) writes of being presented with baskets filled with leaves of the cassine.

Was it an article of commerce? There seems to be no doubt on this subject. Allusions to the drinking of the "black drink" are found, indicating its use among tribes residing at a long distance from the habitat of the cassine.

Lawson (1709) writes of its being "collected by the savages of the coast of Carolina, and from them sent to the westward Indians and sold at a considerable price." Dr. Porcher, author of the "Resources of the South," says: "The Creek Indians used a decoction of the cassine at the opening of their councils, *sending to the seacoast for a supply*," and adds that the coast Indians sent it to the far west tribes. How far its use extended northward, I cannot ascertain. From some allusions of the early French writers, I think it was used by the Natchez, and that it was sent up the Mississippi from the coast of Louisiana. The Indians of Wisconsin, Illinois, and westward, used a decoction of willow leaves as a beverage, but I cannot find that they used it in ceremonials, or that it was looked upon with the same reverence.

It appears from the accounts of various early writers that there were several methods of preparing the black drink.

(1) The decoction made of the fresh leaves and young branches.

(2) A decoction of the dried and roasted leaves. It is probable that the leaves during roasting developed new qualities, as the roasting of coffee brings out the aromatic odor due to a volatile oil.

(3) A decoction which was allowed to ferment. In this condition it became an alcoholic beverage, capable of causing considerable intoxication, similar to that caused by beer or ale.

The early history of the use of *Ilex cassine* as a beverage is lost in the darkness of prehistoric ages. Probably the same can be said of tea, coffee, maté, and cocoa. But it is a singular fact that while all the latter beverages still continue to be used in the countries where they are indigenous, as well as all over the world, the use of cassine is nearly extinct, as it is now only used occasionally in certain important religious ceremonies by the remnants of the Creek Indians, and will disappear with them unless rescued by chemical research and its use revived for hygienic or economical reasons.

The very earliest mention of cassine was made in the "Migration Legend of the Creek Indians." This curious legend has been lately published by A. S. Gatschet of the Bureau of Ethnology, Washington, D.C., with text, glossaries, etc. In his preface he says: "The migration legend of the Kosihta tribe is one of the most fascinating accounts that has reached us from remote antiquity and is mythical in its first part." This tribe was a part of the Creek nation. Its chief, Tchikilli, read the legend before Governor Oglethorpe and many British authorities in 1735. It was written in red and black characters (pictographic signs) on a buffalo skin. This was sent to London, and was lost there; but, fortunately, a text of the narrative was preserved in a German translation.

It begins by narrating that the tribe started from a region variously supposed to be west of the Mississippi, or in southern Illinois, or southern Ohio. They travelled west, then south, then south-east, until they reached eastern Georgia. Here they met a tribe, called in the legend the "Palachucolas," who gave them "black drink" as a sign of friendship, and said to them, "Our hearts are white, and yours must be white, and you must lay down the bloody tomahawk, and show your bodies as a proof that they shall be white."

This was evidently the first knowledge the Kosihta tribe had of this beverage.

The black drink made by the Seminoles is described as "nauseous to the smell and taste, and emetic and purgative." It is a mixture and not brewed of the cassine alone. All our beverages, such as tea, coffee, maté, and even chocolate, when drunk very strong, are capable of causing diuresis, purging, and vomiting.

[1] Abstract of Bulletin No. 14, U. S. Department of Agriculture, Division of Botany, Edwin M. Hale, M.D., Chicago, Ill.

[2] This was written before Professor Venable's recent investigations.

One peculiarity of the drinking of the black drink is that, so far as I can ascertain, it was not used at their meals as we use tea and coffee, but wholly as a social beverage or at festivals and other public occasions. I do not think the women were allowed to drink it, at least not publicly. Authorities differ on this point.

Among the Creeks the women sometimes prepared the black drink, but Narvaez writes that the Indians on the coast of what is now Texas did not allow a woman to come near it during its preparation.

That a beverage containing caffeine should fall into disuse and become almost forgotten is a singular fact. The use of maté has not decreased from the time of the conquest of South America by Europeans. The reason why the latter is still in use and the former not lies, perhaps, in the fact that the Europeans in South America mixed with the natives, married, and adopted their customs, while the English and French who settled the Gulf States did not associate with the Indians, and adhered to the use of Chinese tea. Now that we know that the leaf of the cassine contains caffeine or theine, can its use as a beverage be revived?

It is not as pleasant in odor and taste as *Thea sinensis*, and this may be against it; on the other hand, it seems to have some salutary properties which the latter does not possess, and may, perhaps, be far more cheaply obtained.

A rough estimate can be made as to the number of square miles upon which it grows. Estimating the coast line from the James River, in Virginia, to the Rio Grande, in Texas — about 2,000 miles — and multiplying this by 20 miles, the extent of its growth inland, we get a total of about 40,000 square miles. On this area could be picked an immense quantity of leaves, and if the trees are not destroyed in the picking the crops could be harvested every year. No estimate can be approximated even of the amount of the crop of leaves which could be gathered, because we can not estimate the number of trees on this area.

It would seem possible that further inquiries on this point and careful experiments in cultivation and manipulation might result in furnishing our market with a product which would be found in many cases an acceptable and useful substitute for the more expensive imported teas.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

Rain-Making by Concussion in the Rocky Mountains.

IN connection with the recent discussions of the effects of explosions in producing rain, it ought to be noted that for twenty years or more the Rocky Mountains have afforded excellent opportunities for observing the effects upon rainfall of heavy explosions at high elevations. There are in this region thousands of mines, mining claims with open cuts and adits, and quarries at elevations from 5,000 to 13,000 feet. Nitro-glycerine preparations are now the explosives used in blasting. During the summer there is a great amount of blasting high on the mountains. Several railways and wagon roads reach 9,000 to 12,000 feet, and the grading of these afforded much blasting. I have made considerable inquiry and found no one who had observed any connection between the explosions and rain-fall. Probably few or none were especially on the watch for such connection, but if there were any very obvious connection it would have been observed, since there have been so many years of opportunity.

About two years ago the cog-wheel road was graded to the top of Pike's Peak. Thinking that explosions on a high isolated mountain, rising far above the adjacent country like Pike's Peak, would produce rain if anywhere, I especially noted the weather. Tremendous explosions occurred daily for some months. The reports were often heard 30 to 40 miles, and many of them were at elevations between 13,000 and 14,147 feet. Yet all this happened in one of the dryest years ever known in Colorado, when often for days or weeks there was no precipitation even on the mountains.

G. H. STONE.

Colorado Springs, Jan. 12.

Rain-Making.

IN *Science* for Nov. 27, 1891, appeared an article from the pen of Professor Lucien I. Blake of the State University of Kansas, entitled "Can We Make it Rain?" in which some suggestions are made as to the proper method of conducting experiments to that end, drawn from the discoveries of Mr. John Aitken of Scotland, who has shown that unless there be dust particles in the air the aqueous vapor therein contained will not, in condensing, form itself into drops. Professor Blake argues from this that, instead of using guns or apparatus for producing terrific noises, the better way would be to send up inexpensive fire balloons carrying impalpable powders, which could be thus scattered through the air; or else carrying sulphur or gun-powder, the smoke of which, when they were ignited, would furnish the dust particles, which, it is assumed, are the only requisites for artificially setting in motion the process of nature that brings rain.

The reasoning of Professor Blake in leading up to this conclusion and in combatting the idea that concussion is a necessary factor in artificial rain production, contains much that appears sound from the standpoint of both science and good sense, and yet much that will not bear examination. His contention that thunder does not, to any extent, cause condensation of vopor, but is rather the result of it, is one which I have always held to, for latent heat is given out by condensing vapor, and this heat may appear in the form of electricity, and cause the lightning-flash that makes the thunder. The idea, also, that powder smoke may be a factor in rain production when rain is caused by a battle, is a logical deduction from Mr. Aitken's discovery. Professor Blake also avoids the blunder committed by Professor Simon Newcomb, in his article in the October number of the *North American Review*, where the latter lays himself open to the imputation of being himself guilty of the very thing he charges against the advocates of the concussion theory, viz., of "ignoring or endeavoring to repeal the laws of nature." This he does by asserting that ten seconds after the sound of General Dyrenforth's last bomb had died away "everything in the air — humidity, temperature, pressure, and motion — was exactly the same as if no bomb was fired," thus abolishing at one stroke the principle of the conservation of forces. Professor Blake, with less zeal but greater wisdom, practically admits that the forces brought into action by explosions are resolved into heat, and he does not, like Newcomb, annihilate this heat, though unwilling to admit that it can do work. Professor Blake also has the good sense to recognize the fact that the question of artificial rain production cannot be settled by laboratory experiments — a thing that cannot be said of all the assailants of the concussion theory.

But his contention that if concussion causes rain "the greatest effect — the practical effect — must follow close upon the concussion," cannot be sustained. While I reserve for a more extended article to be published elsewhere a full consideration of this question, I will here say, briefly, that the well demonstrated theory of the late Professor M. F. Maury that there are two great atmospheric currents, the equatorial and the polar, flowing above us in nearly opposite directions, furnishes the basis for a perfect explanation of the reason why the centre of the atmospheric disturbance caused by a battle should remain in the vicinity of the battle-field while the two currents are mixing together and initiating the process that leads to rain — a process which, it is plain, must require time in reaching a state of effective action.

But these points in the discussion are not so much what I desire to consider at this time as the special method recommended by Professor Blake for conducting rain-making experiments. The

advocates of the concussion theory welcome any discoveries that can add to our knowledge of the reasons why battles cause rain, and thus suggest methods for producing it which may be an improvement on these suggested by the battles and their sequences. In this category appears to be the discovery of Mr. Aitken referred to, but it furnishes nothing conclusive on the subject, and, in my opinion, an experiment on the line marked out by Professor Blake would prove a failure. If some of us go to one extreme in relying too much on concussion as the means by which the process of nature that leads to rain can be set in motion, so does Professor Blake go to the other extreme in holding that it is smoke or dust particles alone that can artificially effect that result. We know, as a matter of fact, that simply throwing smoke into the air does not produce rain. There are scores of cities in our land whose chimneys are doing this every day, and yet they do not produce rain. And it cannot be said that the smoke they send up is not of the right kind. It contains a great deal of sulphur and of carbon, and these, according to Prosessor Blake, are among the substances which form dust particles, around which molecules of aqueous vapor most readily collect.

In the light of Mr. Aitken's discovery, however, I am willing to admit the possibility that smoke may not be without its effect in producing the rain that follows battles — an idea, I may add, which, though not original with me, I placed on record over twenty years ago, as may be seen by reference to the letter of Gen. Robert A. McCoy, in the appendix to "War and the Weather." In any future experiments in the field the application of the principle discovered by Mr. Aitken ought to be duly tested. But I see no reason as yet for doubting that force, exerted by means of explosions and expended on the earth and air, is a necessary factor in artificial rain production.

EDWARD POWERS.

El Paso, Tex., Jan. 15.

Eye-Habits.

IN *Science* of Dec. 18, 1891, p. 339, is a note taken from *Nature*, and referring to some experiments of Mr. James Shaw to test the ability of school children to keep one eye open and the other shut at the same time. Having been associated with school children for many years where the microscope was frequently used in the class-room for demonstration, my attention has often been called to their proceedings in this respect, and the impressions may be worth recording, though they are, no doubt, essentially like those of many other teachers in analogous positions. As the use of the microscope was only for a short time to each individual in a particular exercise, it was necessary that an observer looking into the tube of a monocular should by some means close one eye in order that other objects might not be in the field of view of the unoccupied eye and confuse the image. For it requires long practice on the part of one using a monocular stand to examine an object while keeping both eyes open and not be inconvenienced, a training out of question with school children where the time was limited. In the case of such the eye was closed either with or without the use of the hand. Being pupils in a high school their ages ranged from fourteen to twenty or more, the majority from fifteen to eighteen. Statistics were not kept, but I do not recall an instance where a boy could not close one eye without the aid of the hand. If it occurred, it was very rare. But it was quite common for girls to make use of the hand for this purpose, a fourth or more, as mentioned by Mr. Shaw for school children.

Sometimes, by request of teachers in primary grades, I have taken a microscope to their rooms, in which the lowest classes were taught, their ages being from six to eight or nine. It was for the purpose of showing something which the teachers desired to use as an object-lesson, like the eye or foot of a fly, or the scales from the wing of a butterfly, things whose forms they readily comprehended, as was shown by their description of them. With them the unaided closing of one eye was exceptional, some of the older boys, perhaps, being able to do so. I have noticed the same difficulty with older people who occasionally look through a microscope; the inability to shut one eye and leave the other open being among the women. This was illustrated but a short time since by a lady nearly eighty years old. She had recently had one eye treated for cataract, and was told to test the perceptive power of it. In order that there might be no interference by the other eye, this was covered by the hand.

This habit of peeping, or looking with one eye open and the other closed, is plainly an acquired one, becoming easy by practice, as is seen by comparing children with adults, and men and women with each other. The difference in the latter is mostly due to the lack of use. Boys early become accustomed to "sighting" in various ways in their play, as in the use of the cross-bow or bow and arrow, toy gun or real gun, or they may wish to line something. They also work more with tools, and, like a carpenter, must see if they are making a straight edge, and thus acquire this ability. There being less occasion for it on the part of girls and women, they may fail to gain it at all. This is not from inherent inability any more than in the case of men, unless heredity becomes a factor working through sex, and facilitating the process.

E. J. HILL.

Englewood, Chicago, Jan. 14.

BOOK-REVIEWS.

Chambers's Encyclopædia. New edition. Vol. VIII. Peasant to Roumelia. Philadelphia, Lippincott. Royal 8°. $4.

COMMENT on this encyclopædia may seem almost superfluous, not only because the work is well known, but also because of the uniform excellence of its several volumes; yet one does not like to pass it by without remark. The present volume is noteworthy for the number of its articles on philosophical and religious topics; Professor Andrew Seth writing on Philosophy, Professor D. G. Ritchie on Plato, Professor Sorley on Psychology, Mr. James Oliphant on Positivism, Professor Flint on Religion, Rev. W. L. Gildea on Roman Catholicism, Professor Cheyne on the Book of Psalms, etc. In the very different department of the industrial arts we find articles on Photography, by T. C. Hepworth and W. T. Bashford; on the Plough and the Potato, by James MacDonald; on Pottery, by James Paton; on Printing, by John Southward; and a long one on Railways, by E. M'Dermott. In science strictly so called, Professor Peile treats of Philology, Mr. Norman Wyld of Plants and of Physiology, Professor Knott of Quaternions, Dr. Alfred Daniell of Reflection and Refraction, Mr. J. A. Thomson of Protoplasm and of Reproduction; while the minor articles are too numerous to mention. In history and geography the most important papers are perhaps those on Phœnicia, by Canon Rawlinson; on Rome, by Canon Taylor and Dr. Steele; and on Persia and Persepolis, by Gen. R. Murdoch Smith. In this department it seems to us that there is a deficiency of maps. Political and social themes receive their share of attention, Mr. T. Kirkup treating of Political Economy, Mr. Jesse Collings of Peasant Proprietors, Mr. W. C. Smith of the Poor Laws, Sir E. F. Du Cane of Prisons, and Mr. W. Draper Lewis of Protection. Literature and the ideal arts are less conspicuous in this volume than in some of the previous ones; but Mr. Edmund Gosse writes of Poetry, Mr. Stead of Periodicals, Sir Joseph Crowe of Raphael, Mr. P. G. Hamerton of Rembrandt, and Mr. W. Holman Hunt of Pre-Raphaelitism. The number of minor articles on all subjects is so great as to preclude all mention of them individually; yet it not unfrequently happens that these are the most useful of all to the reader. It is expected that the two remaining volumes of the Encyclopædia will appear during the present year.

AMONG THE PUBLISHERS.

THE new volume of the Badminton Library, announced by Little, Brown, & Co. for immediate publication, will treat of skating, curling, tobogganing, and other out-door sports. It is written by J. M. Heathcote, C. G. Tebbutt, T. Maxwell Witham, and the Rev. John Kerr, Ormond Hake and Henry A. Buck, and contains several plates and numerous illustrations in the text, by C. Whymper and Captain Alexander.

— John Wiley & Sons announce as in preparation "Elementary Lessons in Heat," by Professor S. E. Tillman, United States Mili-

tary Academy, and "Elementary Course in Theory of Equations," by C. H. Chapman, Johns Hopkins University.

— A. Lovell & Co., New York, have begun the publication of a series of American History Leaflets, to be issued bi-monthly. The first contains Columbus' letter to Luis de Sant Angel, announcing his discovery.

— Houghton, Mifflin, & Co. have just published the third volume of Sargent's important work on the Silva of North America. It will include Anacardiaceæ-Leguminosæ, and, like the previous volumes, will contain fifty plates drawn and engraved with the utmost skill.

— Charles H. Sergel & Co. announce a series of histories of the Spanish-American Republics. The first volume, which will be issued in February, will be "Peru," by Clements R. Markham. It will be followed in a short time by "Brazil," by William E. Curtis. "Argentine," by the Author of "An Earnest Trifler," and other volumes will be issued at intervals of two or three months.

— Longmans, Green, & Co. have published a small atlas prepared by Professor A. B. Hart of Harvard University and entitled "Epoch Maps Illustrating American History." It is primarily designed as a companion to the series on "Epochs of American History" published by the same house, of which Professor Hart is the editor. The author says that it is "an attempt to make maps from the records — from the texts of grants, charters, and governors' instructions, and from statutes, British, colonial, state, and national." It opens with a map showing the physical features of the United States, followed by several illustrating the early discoveries and settlements, and others showing the growth of the national territory, the settlement of disputed boundaries, the growth and abolition of slavery, the civil war, and various other phases of our national history. There are, however, no maps of particular regions of special historical importance, such as New Jersey in the Revolution and Virginia in the civil war — an omission that is to be regretted. But the maps that are given are excellent, and as history without maps is almost unintelligible, they will be useful to historical students.

J. B. Lippincott Company have just published a second edition of Goubaux and Barrier's "The Exterior of the Horse," translated by Dr. Simon J. J. Harger of the University of Pennsylvania. This edition has been in preparation for three years, involving many alterations, which in most cases amounted to almost a transformation of the old text into entirely new matter. A new plate upon the age, by G. Nicolet, and fifty-three original figures have been added, making the total 346 figures and 34 plates.

— Benjamin Sharp, Ph.D., will tell in the February *Scribner* some results of his Greenland explorations last summer. He describes what Sir John Ross, who discovered them in 1818, called

CALENDAR OF SOCIETIES.

Philosophical Society, Washington.

Jan. 16. — W. J. McGee, The Gulf of Mexico as a Measure of Isostasy.

Society of Natural History, Boston.

Jan. 20. — Charles V. Riley, Life-History of Sphecius Speciosus, Drury; Notes on Caprification; S. H. Scudder, The Tertiary Weevils of North America.

Chemical Society, Washington.

Jan. 14. — Officers were elected: President, Dr. T. M. Chatard; vice-presidents, Dr. F. P. Dewey and Mr. W. H. Krug; treasurer; Dr. E. A. von Schweinitz; secretary, Dr. A. C. Peale. The following were elected additional members of the executive committee: Professor F. W. Clarke, Professor H. W. Wiley, Mr. Cabell Whitehead, and Professor R. B. Warder. The following papers were read: H. W. Wiley and K. P. McElroy, Midzu-Ame; W. F. Hillebrand, Zinc-Bearing Spring Waters from Missouri.

Appalachian Mountain Club, Boston.

Jan. 13. — Herbert Dyer, Camping in the Highest Sierras.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

WANTED.—(1) A white man versed in wood and iron working, able to work from specifications and plans, suited for an instructor of boys; his business to have charge of shops of school, outline and direct the work for foremen and students; salary to be $1,000 per annum (nine months). (2) A man (black preferred) to teach the colored, iron working and forging, subordinate to the preceding; salary, $720. (3) A man (white) competent to take classes in engineering (assistant's position), but with the ability to perform any of the work required in any of the ordinary engineering courses of our universities; salary from $1,000 to $1,500. A. H. BEALS, Milledgeville, Ga.

WANTED.—Two or three efficient computers with good knowledge of Spherical Trigonometry and ready use of logarithms, for temporary employment in the office of the Coast and Geodetic Survey. Applicants should furnish evidence of their fitness for the work. Apply by letter to the Superintendent, Coast and Geodetic Survey, Washington, D C.

WANTED.—*Science*, No. 178, July 2, 1886, also Index and Title-page to Vol. VII. Address N. D. C. Hodges, 874 Broadway, New York.

A YOUNG MAN (31) would like a position in a college, laboratory, or observatory, is also willing to assist at a steam engine, etc. Address J. W., care of *Science*, 874 Broadway, New York.

WANTED.—A position in the philosophical or pedagogical department of a college or university by a young man (30) who has had five years' practical experience in teaching, and who has done four years' post-graduate work in philosophy, devoting his attention during the last two years especially to study and original investigation in scientific psychology and its applications in education. Address E. A., care *Science*, 874 Broadway, N. Y. City.

WANTED.—A suitable position in Washington, D. C., not connected with the Government, and with a salary not to exceed $650 a year, by an experienced biologist with six years' university training. Applicant has been a skilful surgeon for fourteen years; is a practical photographer, cartographer, and accustomed to the use of the typewriter. He is also capable of making the most finished drawings, of any description, for all manner of illustrative purposes in science; trained in museum methods and work; also field operations and taxidermy in its various departments, and modeling, production of casts, restorations of paleontological specimens and similar employments. Address U. S. R., care *Science*, 47 Lafayette Place, N. Y.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

Wanted to buy or exchange a copy of Holbrook's North American Herpetology, by John Edwards. 5 vols. Philadelphia, 1842. G. BAUR, Clark University, Worcester, Mass.

For sale or exchange, LeConte, "Geology;" Quain, "Anatomy," 2 vols; Foster, "Physiology," Eng. edition; Shepard, Appleton, Elliott, and Stern, "Chemistry;" Jordan, "Manual of Vertebrates;" "International Scientists' Directory;" Vol. I. *Journal of Morphology;* Balfour, "Embryology," 2 vols.; Leidy, "Rhizopods;" *Science*, 18 vols., unbound. C. T. McCLINTOCK, Lexington, Ky.

For sale.—A 6½ x 8½ Camera; a very fine instrument, with lens, holders and tripod, all new; it cost over $40; price, $25. Edw. L. Hayes, 6 Athens street, Cambridge, Mass.

To exchange Wright's "Ice Age in North America" and Le Conte's "Elements of Geology" (Copyright 1882) for "Darwinism," by A. R. Wallace, "Origin of Species," by Darwin, "Descent of Man," by Darwin, "Man's Place in Nature," Huxley, "Mental Evolution in Animals," by Romanes, "Pre-Adamites," by Winchell. No books wanted except latest editions, and books in good condition. C. S. Brown, Jr., Vanderbilt University, Nashville, Tenn.

For Sale or Exchange for books a complete private chemical laboratory outfit. Includes large Becker balance (200g to 1-10mg), platinum dishes and crucibles, agate motors, glass-blowing apparatus, etc. For sale in part or whole. Also complete file of *Silliman's Journal*, 1862-1885 (62-71 bound); Smithsonian Reports, 1854-1883; U. S. Coast Survey, 1854-1869. Full particulars to enquirers. F. GARDINER, JR., Pomfret, Conn.

For exchange or sale at a sacrifice, an elaborate microscope outfit. Bullock stand; monocular objectives, one-sixth homeogeneous immersion, four-tenths, and three inch, Bausch & Lomb, also one-fourth and one inch Spencer. Four eye-pieces. Objectives are the best made. Address Mrs. Marion Smith, 41 Branch Street, Lowell, Mass.

BOOKS: How to Exchange them for others. Send a postal to the SCIENCE exchange column (insertion free), stating briefly what you want to exchange. SCIENCE, 874 Broadway, New York.

the "Arctic Highlanders," an isolated race of two hundred souls, which at the present time has about the same numbers as when first discovered. The author says: "Government they seem not to have, the oldest man of the family at most ruling that family. Of the customs, as marriage and religion, little or nothing is known, but we hope that the investigations of Lieut. R. E. Peary, who is now among these people, will throw much light upon this interesting chapter of their story." The results of these investigations will appear in *Scribner's*.

— A translation of the new book by the famous Egyptologist, G. Maspéro, entitled "Life in Ancient Egypt and Assyria," is to be published immediately by D. Appleton & Co. In this work the author does not present a dry history of dynasties, but he gives a picture of actual life in its various phases among the two most civilized nations which flourished before the Greeks. Life in the city streets, in the huts of the poor and the palaces, marriage ceremonies, funeral and religious rites, hunting scenes, and battles, are all reproduced. The numerous illustrations by M. Fancher-Gudin are worthy of the importance of the book. As the author says, "It is the Egyptian and Assyrian himself that these illustrations show us, and not those caricatures of Egyptians and Assyrians which are too often seen in our books." Of this book the London *Academy* says: "It fills a real gap. It is fortunate that this new way of treating the materials supplied by the papyri, the cuneiform tablets, and the monumental remains of Egypt and Assyria was not earlier attempted by another hand, for who could have treated that material with the ease, the mastery, and the vivacity of M. Maspéro?"

— It has been known for some time past that M. Ernest Renan was engaged in writing a volume of reminiscences. The book is now finished, and by arrangement with the author will soon be published by the Cassell Publishing Company under the title "Recollections, Letters, and Addresses." The translation has been done by Miss Isabel F Hapgood.

SCIENCE

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

PUBLISHED BY N. D. C. HODGES, 874 BROADWAY, NEW YORK.

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CONTENTS.

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QUERY.

Can any reader of *Science* cite a case of lightning stroke in which the dissipation of a small conductor (one-sixteenth of an inch in diameter, say,) has failed to protect between two horizontal planes passing through its upper and lower ends respectively? Plenty of cases have been found which show that when the conductor is dissipated the building is not injured to the extent explained (for many of these see volumes of Philosophical Transactions at the time when lightning was attracting the attention of the Royal Society), but not an exception is yet known, although this query has been published far and wide among electricians.

First inserted June 19. No response to date.

N. D. C. HODGES,
874 BROADWAY, NEW YORK.

SCIENCE

NEW YORK, FEBRUARY 12, 1892.

ON THE TEACHING OF ANATOMY TO ADVANCED MEDICAL STUDENTS.[1]

THE importance of anatomy to the physician and surgeon has caused the method for teaching this science to be largely determined by practitioners. The student is taught the elements of histology, the shapes and numbers of organs, the outlines of regions, and their mutual relations. Other facts than those named belong in a very remote degree to the needs of practice; and when the great number of medical topics is considered, which is of necessity brought to the attention of the student, it is no wonder that governing bodies are disposed to disregard all phases of instruction that do not have direct claim upon the physician's time and service.

But science is rarely pursued for practical good. The acquisition of knowledge for its own sake — the determination of general principles that reveal the existence of law — awakens and maintains pleasures and interests in the mind of the anatomist compared with which the practical uses that he can make of the knowledge appear to be poor and mean. With as much propriety one might say that navigation is the highest use that can be made of the study of astronomy, as to assert that the chief end of the study of anatomy is to apply its tenets to medicine. These statements are made not to lessen the dignity and importance of practical work, but respectfully to claim that such work does not comprise all the value, indeed scarcely more than a small fraction of the value, that pertains to the whole.

In his "New Atlantis," Lord Bacon says: "We have three of our fellows that bend themselves, looking into the experiments of others, and cast about how to draw out of them things of use and practice for man's life, and knowledge, as well for works as for plain demonstration of causes, means of natural divinations, and the easy and clear discovery of the virtues and parts of the bodies. These we call dowrymen or benefactors. Lastly, we have three that raise the former discoveries by experiments into greater observations, axioms, and aphorisms. These we call the interpreters of nature."

I hear a response to the foregoing statement that the structure of animals exhibited on a broad scale is already taught to classes in the scientific schools, and that, in the scheme of a university education, the biological subjects are as well advanced as any others in the curriculum. This is an imperfect, if not misleading, presentation of the facts. It is true that the rudiments of the structure and functions of animals and plants are taught. But to students already advanced by general training and by preliminary work in natural history, little is presented that prepares them to discuss the more intricate problems.

To my mind the scheme of university work is unsatisfactory until opportunity is afforded to men, who, after completing their biological and medical training, may desire to still further advance. Conceding that the question of maintenance has been settled, either by the possession of private means or by endowment of fellowships, what courses of instruction are afforded these advanced men? As a rule, nothing, or next to nothing. It is customary for such novitiates to reside abroad for several years, where, amid numerous centres of learning are found one or more masters, the disciples of whom they become. The advantages of travel being considered, it may be said that with the comparatively easy means of obtaining the best instruction the present scheme is on the whole adequate. With such a conclusion I cannot agree. If it were true, we might in reason have stopped long ago in our lines of university expansion. Independence in intellectual as well as in political life should be the object of American citizenship.

First, and always, let us remember that medical investigators are those it is desired to train. It is for men that are already imbued with the desire to pursue their researches in anatomy that I appeal. They stand in this field with what preparations can be given them for usefulness. They are medical biologists — medical anatomists. They are not restricted to the problem of the relief of suffering, and yet they are occupied with those other problems upon which the true solution of all depends.

For such instruction I would have a specially-designed museum and a specially-equipped laboratory. It may be assumed that in every great medical school, from among the large number of matriculates (men already trained and of the best quality), two or three of the type described will present themselves for an advanced course in anatomy. I am prepared for the objection that this is too large a number. But, so far as I know, no one has attempted to ascertain how many men in each class of graduates would come forward, and my impressions are based upon the number of workers in the general field of biology — some of whom, at least, would have pursued these or similar studies had any systematized course been presented to them. I will, therefore, begin with three men a year. To this number may be added as many young teachers, tutors, curators, and prosectors, who would avail themselves of the instruction. The work might be initiated in either of the halls of biology or of medicine. If the course were well established, it would be well to institute a laboratory and museum distinct from any on the university grounds. I am of the opinion that the administrative success of such separation of collections would be assured. All must approve of the ethnological collection of Harvard being distinct from the Museum of Comparative Zoology, and of both in turn being set apart from the museum in the Medical School. In like manner, I assume that there is no reason why series of specimens arranged in illustration of principles that are not taught either in the preliminary or in the proper medical courses, should be necessarily connected with one or the other museum. The collections should be in the main designed to accommodate the preparations that are used in the illustration of general lectures. Museums that teach by the specimens being removed from the cases to the lecture halls are radically distinct from museums that teach by the conservation of series that are

[1] Also published in The Medical News, December 26, 1891.

arranged and labelled for instruction as they stand, and which should be rarely, if ever, disturbed.

The following, treated in some detail, embrace the topics that occur to me at this time as appropriate subjects for instruction: The study of the human brain; especially the study of the mammalian and avian brains, both of the gross and the minute anatomy, the localization of functions, etc. The study of muscular anomalies and their homologies in the normal myology of the vertebrates. The study of animal locomotion and its application to the morphology of the vertebrate limb, and in general the application of photographic methods in studying animal locomotion.[1] Studies in craniology, especially the comparative studies of human and mammalian crania. The study of osteological variations, with a similar application to the normal anatomy of the lower animals and the beginning of morbid processes. The study of nutritive processes on tissue as correlated to age.[2]

In addition, courses of experimental morphology might be essayed. Such investigation could be encouraged without encroaching on the domain of physiology, as the votaries of this science somewhat arbitrarily restrict it. Indeed, much of the study of animal locomotion would be experimental, as would also be the study of protoplasm in viscid media, under rotation, compression, etc. The effects of light, temperature, water in motion and at rest, etc., on organization, would naturally find a place. Experiments on mutilation of embryos might also be undertaken.

Lectures on correlation of structure, on vegetative repetition, on the relation existing between phyllogenetic and teratological processes, could be given, as well as the study of the laws of heredity, especially in attempting to answer the question of the transmittal of acquired characters.

The teeth are so responsive to the constitutional peculiarities of the individual that their peculiarities can be seen and readily detected. The method of procuring accurate impressions can be applied, and the plans of preserving the form of teeth be easily accomplished.

As is known to the zoologist, the parts involved in the act of mastication are important in the classification of the mammalia, the slightest departure in the form, number, position, and rate of development of the teeth being for the most part correlated with other variations in the economy, while the shapes of the lower jaw and of those portions of the skull that afford surfaces for attachment of the masticatory muscles are of importance. No structures of the body resemble the teeth in the character of their response to morbid impressions; no other organs are arranged in progressive series; and none other than these are evolved after birth. Hence the effects of disease and accidents to which the teeth are subjected are sure to be recorded in the shapes of the crowns and roots.

If the student of heredity were to have placed at his disposal a collection of the casts of the permanent teeth of three generations — that is to say, of the parent of the subject, the subject himself, and the children of the subject — and if a clinical history were secured of the diseases and accidents that these persons had incurred, a tenable argument might be established as to the significance of the contrasts or resemblances in the forms of the teeth.

Thus, if three generations were expressed by the letters A, B, C, and if B is the subject of an acquired character (let us say from scarlet fever or measles), the new form of structure seen in the second and third molars may be transmitted to C. But in order to prove this it is necessary to know the peculiarities of these teeth in A. Hence, the teeth of the ancestors and descendants of the person who exhibits the acquired character must be known. A somewhat similar plan of observation could be made on the teeth of the lower animals. It is strange that those teeth with endless pulps, in which growth is rapid and interference with their relations causes permanent records to be made in malformation, should not have been used in studies of nutrition.

In connection with myological studies a number of minor problems suggest themselves; such, for example, is the nature of white and red muscles. It has been noted that in ostriches that have been confined in zoological gardens the muscles of the leg undergo fatty degeneration and become white in color; it is also known that the pectoral muscle in many of the gallinæ is white, presumably from the fact that they are used but for short and infrequent flights. How evident is the conclusion that a systematic study of all muscles of active birds living in enforced confinement, as compared with the relatively active muscles in feral forms, might be undertaken with a fair prospect of throwing light upon the nature of the process, and with a hope that the subject of fatty degeneration (even if by this method not elucidated) may have its study placed on a broad basis by subjecting its tenets to the tests of systematized experiment and observation!

The morphological study of the results of diseased action might also be undertaken. The differences that obtain between normal individuals and those the subjects of hereditary disease must be of importance to the anatomist and the pathologist.

The variations in the forms of the bones, as found in medical museums, are of a character that suggest their relation to inherited causes. Every clinical observer has noted the peculiar shape of the chest in families in which pulmonary phthisis is hereditary, even though the special tuberculous deposits are absent in some of its members. The clubbing of the finger-nails is a sign of the same disposition. Some writers, indeed, claim that in this class of subjects a special arrangement of the fibres of the pneumogastric nerve exists. Are these and similar morphological characters susceptible of being also gathered so as to contribute to the discussion of the transmission of acquired characters? Are not opportunities here presented for the medically trained biologist to study the subject of heredity in a line so important and, alas! with material so abundant? Other hereditary diseases, such as struma, syphilis, and gout, are less strongly marked than is the tuberculous, but even on this obscure horizon landmarks are detected that are of sufficient definiteness to guide the observer to well-defined plans of study. The animals of zoological gardens exhibit examples of acquired struma, the effects of which more especially distinguish the skeleton. Can any of these characteristics be transmitted? How would the skeleton of a tiger, let us say, born in captivity in the third and forth generation differ

[1] Instantaneous photographs have given us definite conceptions of the behavior of the manus and pes in terrestrial and aerial movements. I had the honor to point out as a result of a study of the negatives taken by Mr. E Muybridge under the auspices of the University of Pennsylvania, that the ground is touched by the outer border of the foot and is left by the inner border, and that the impact represented by this transition is expressed by an oblique line that extends from without inward (ecto-entad) across the metapodium. Professor H. F. Osborne, by studying the carpus and tarsus in extinct forms of mammalian life, has found that this conclusion is of value in studying the evolution of the parts. From this we can conclude that, as a result of a photographic plant in connection with advanced anatomical work, discoveries could with some confidence be anticipated.

[2] This would form a morphological study on the nature of age, and would more particularly embrace a consideration of the immature and senile forms as compared with the typically adult, as well as the retention of juvenile characters in the adult.

from that of a feral type? After what manner may one expect taxonomic characters modified in these generations of prisoners?

The nature of malignant growths, it is not improbable, would find a solution in a line of research based upon a similar proposition. What proportions of malignant growths, such as the sarcomata, are met with in the feral state of quadrupeds as compared with those in the domesticated or the captive state? Can experiments be devised by which we may expect to cause these growths to appear by creating the favoring conditions? Can we study the genesis of the sarcomata to better advantage than has hitherto been done, by outlining the biography, the lineage, and to some extent possibly the destiny, of these tumors, by applying to them experimental methods of research?

Medically trained men are not apt to become pure morphologists. The underlying thought is of *function* through which *structure* is modified. In its best sense, therefore, physiological anatomy is the branch of science that would be most developed. Let us suppose that John Hunter had lived in 1891 and had essayed his work by all the aids of modern science, and had undertaken a plan of investigation for the continuation of his labors: might he not have accepted some such scheme as I have feebly attempted to portray? With the admiration we feel for his genius, let us not only have Hunterian orations, but in each medical centre a Hunterian laboratory and a Hunterian museum.

"I am so utterly opposed to those cloud-builders who would divorce physiology from anatomy," says Haller, "that I am persuaded that we know scarcely anything of physiology that is not learned through anatomy" (quoted from R. Cresson Stiles's "Life and Doctrines of Haller," New York, 1867).

In Solomon's house, in the "New Atlantis," in which Bacan essayed a scheme for intellectual advancement, we read of "parks and enclosures of all sorts of beasts and birds, which we use not only for view or rareness, but likewise for dissection and trials, that thereby we may take light what may be wrought upon the body of man; we have also particular pools where we make trials upon fishes, as we have said before of beasts and birds."

I hear objections that this scheme is visionary and impracticable. How is the money to be obtained by which it can be rendered feasible? Where is the teaching-force to be recruited? My answer is that if the need of establishing such a course be acknowledged, the accomplishment of the end in view is no more difficult than in any other branch of pure science. A few years ago the establishment of seaside laboratories would have been thought chimerical. Now they are assured successes.

If I am told the results obtained will appeal to but few, I reply that important projects must be supported in proportion as they so appeal, until such time as they shall have proved their right to exist. HARRISON ALLEN.

TIME-SERVICE OF HARVARD COLLEGE OBSERVATORY.

THE time service of this observatory has been maintained for nearly twenty years upon the system originated by the late Professor Joseph Winlock. Continuous signals, that is, signals throughout the entire twenty-four hours instead of for a short time each day have been furnished to the cities of Boston and Cambridge, and have been used to strike the bells of the fire-alarm daily at noon. For many years a time-ball has been dropped, thus furnishing a precise time-signal to many citizens and to the shipping in the harbor. The continuous signals have been sent also to the railroads centring in Boston, and to the Boston office of the Western Union Telegraph Company, and have been distributed by them over a large part of New England. Many cities and corporations, although not subscribing for the time-signals, have been in the habit of taking them from the railway and telegraph stations, thus extending their use. The time-service in New York City was thus supplied with our signals for many years. The signals, again, have been furnished to the principal jewellers in Boston and vicinity, and used by them in the rating of fine watches The lines transmitting the time-signals in these various directions affected the telephone lines by induction and otherwise, and thus many other persons obtained the signals by merely listening at the telephone.

The subscriptions of the city of Boston and of the railroads, and the receipts from the jewellers were sufficient to defray the cost of furnishing the exact time, and for some years formed a source of revenue to the observatory. No charge was made to the city of Cambridge or to the Western Union Telegraph Company. The expenses were, however, large, since it was necessary to duplicate the instruments and clocks employed, although the cost of the necessary duplication of the lines connecting the observatory with Boston was diminished by the arrangement with the Western Union Telegraph Company. For several years, also, the city of Cambridge rendered similar assistance. Although the best clocks were used and mounted in vaults specially constructed so as to secure a uniform temperature, great care was necessary to keep not only the errors, but also the changes in daily rate, as small as possible. It was necessary to compare the clocks frequently, and to determine their errors by observations of the stars at short intervals. Especially after several days of cloudy weather, the first opportunity was taken to secure observations, although this often occurred at inconvenient hours. Frequent interruptions took place on the lines, and it was therefore necessary constantly to have men ready to detect and repair breaks, crosses, and other injuries.

The general introduction of standard time was considered at the observatory some months before this step was taken. Since the same signals could be used throughout the entire country, it was recognized as a source of danger pecuniarily to the time-service. This argument, however, was allowed to have no weight, since it was believed that the change would be a benefit to the public. As it happened, this observatory was enabled to take an active part in making the change, since all of the railroads centring in Boston assented only on condition that our signals should be sent according to the new system. When the change had been decided upon, various steps were taken by the officers of the observatory to secure the general and simultaneous adoption of the new time by the country.

A new source of difficulty and danger in distributing time-signals has arisen during the last few years. The great increase in the number of telephone and other wires has rendered it much more difficult to maintain an unobstructed circuit. Breaks and crosses are continually occurring, especially in stormy weather; and the privilege of placing wires on housetops is every year less willingly granted. Recently a more serious danger has arisen. The currents of high tension carried by electric-light and electric-railway wires, in case of a cross, may be transmitted indefinitely,

causing danger of fire, bodily injury, or even loss of life. Pecuniary liabilities in such cases may be very great. The financial officers of the university regard such risks as more than offsetting the receipts for the time-signals.

One of the greatest advantages of the time-service to the observatory has been that it kept before the public the practical value of astronomical work. Many thousands of persons who take no interest in work of a purely scientific character recognize the great financial value to the public of an accurate system of time. The observatory desires to confer this benefit on the public, and it would be ready to do so even at a financial loss. But recently the time-signals of the United States Naval Observatory have been offered to the public at very low rates, through the Western Union Telegraph Company. This can the more readily be done since the expense of furnishing the time is borne by the people through a government appropriation, while the company has the largest facilities for the maintenance of telegraphic connections. The Harvard College Observatory is therefore relieved of this duty. If the public is to be the gainer, signals of equal accuracy and continuity must be furnished. Unfortunately, signals sent to a great distance are liable to frequent interruptions from trouble with the telegraph lines, and therefore secondary clocks must be used in each large city if continuous signals are to be distributed. These clocks must be constantly compared and corrected if great accuracy is to be attained, and it is still a question whether satisfactory results can be secured outside of an astronomical observatory. If the results prove unsatisfactory, however, the responsibility for trying the experiment will not rest upon this observatory.

In view of the facts stated above, it has been decided to discontinue the time-signals furnished by this Observatory after March 31, 1892. An earlier date would have been selected, but for the desire to give our subscribers sufficient time to make other arrangements for securing signals.

The most important events in the history of the time-service are given below. The first transmission of time from the observatory to Boston was over a line hired for the purpose and used occasionally for the comparison of clocks in Boston with the standard clock at Cambridge. From 1856 to 1862 the observatory owned a line for the same purpose. Up to the close of 1871, no charge was made for the time thus furnished, which was used for many years for striking the fire-alarm bells of Boston at noon, and for other purposes. The regular transmission of signals and the receipt of compensation for them began in 1872, the service being under the direct care of Professor Winlock, who had devised the system. After his death in 1875, Professor W. A. Rogers took charge of the service and introduced the custom of telegraphing information as to the error of the signals at a given hour daily. In 1877 Dr. Leonard Waldo took charge, and during the next year, with the liberal co-operation of the Equitable Life Assurance Company, the Boston Time-Ball was erected on top of the building of that company. In 1878, also, a correspondence was opened with the railways of New England relative to a uniform system of time and the practicability of introducing it by legislation. A plan for establishing a bureau for the testing of fine watches and thermometers was considered, and abandoned on the ground that such work would be commercial rather than scientific, and therefore not within the scope of the observatory. In 1879, Professor Frank Waldo, who had previously assisted his brother, took charge of the time-service. The error of the standard sidereal clock was determined every day at 10 A.M. from the latest comparisons with the stars, assuming the rate to continue uniform. The mean-time clock was compared with this, and for several years the difference had been communicated every day by telegraph. This practice was abandoned, since it was easy to reduce this difference to zero, and it did not indicate the true error of the clock. Especially during continued cloudy weather, large changes might take place in the rate of the sidereal clock, which could not be determined until observations could be made of the stars. At this time the signals were sent to New York, and were used in the time-service of that city in combination with similar signals sent from the Naval Observatory and Allegheny Observatory. It developed the interesting fact that the differences, sometimes amounting to several seconds, were much greater than were expected, or than would be derived from combining the supposed errors of the different time-services. This was regarded as a preliminary trial of a plan which was developed later, and appears to be the only way of effecting a great increase in the accuracy of time-signals. It is easy to keep the errors of a clock small if the weather is clear, and frequent comparisons can be made with the stars. During long periods of cloudy weather, however, when no observations of the stars can be made, it is very difficult. The slight changes of rate to which even the best clocks are liable may cause serious errors at the end of several days. The remedy is co-operation between observatories so distant that it would seldom happen that clouds would prevent observations at all of them. The time would be determined at each observatory every evening, when it was possible, and the result transmitted telegraphically to a central station; also when called for, as soon as it cleared, whatever the hour. The central station would report daily to each observatory either the results of each observation received or a corrected error derived from them all. Each observatory might send its own time or receive signals from a normal clock at the central station. Mr. J. Rayner Edmands, who has had charge of the time-service from June, 1881, to the present time, rendered important aid in forming this plan. He postponed the record of the errors occurring during cloudy weather until observations could be made for determining them. The apparent errors were thus increased, but the actual errors were represented with much greater accuracy. The practice of making the error at 10 A.M. especially small was abandoned, and attention was given to keeping the signals as accurate, and the daily rate as small as possible at all hours. The general introduction of standard time was effected at noon on Nov. 18, 1883. After the change was decided upon, a large part of Mr. Edmands's time for several weeks was devoted to securing the assent of the public throughout New England to the proposed change. In 1885, a new time-ball was erected on the Boston post-office building, with the aid of an appropriation from the city of Boston. Experiments were made in various matters associated with the distribution of accurate time. Among others, a delaying apparatus was devised, by which the signals of a clock could be retarded by any desired fraction of a second, so that, without disturbing a clock, its apparent error could be varied at will. In 1889 some interesting experiments were made by Mr. W. P. Gerrish on distributing time accurately by flashes of magnesium powder. Signals were thus sent from a station on Blue Hill, twelve miles distant. They were readily visible, and the exact time to within a fraction of a second could be taken from them. These flashes were also seen from Princeton and Mount Wachusett, forty-four miles distant, and from numerous nearer points. From an

early period in the life of the time-service, the telegraphic lines have been in charge of the electricians, Messrs. Stearns and George, and their successor, Mr. C. L. Bly.

EDWARD C. PICKERING,
Director of the Astronomical
Observatory of Harvard College.

Cambridge, Mass.

NOTES AND NEWS.

MR. J. L. KIPLING says of the monkeys of India: "They have a game like the English boys' cock of the dung-hill or king of the castle, but instead of pushing each other from the top of a knoll or dust-heap, the castle is a pendant branch of a tree. The game is to keep a place on the bough, which swings with their weight as with a cluster of fruit, while the players struggle to dislodge one another, each, as he drops, running round and climbing up again to begin anew. This sport is kept up for an hour at a time with keen enjoyment, and when one is nimble as a monkey it must be splendid fun."

— In 1890 was published the important discovery by Behring and Kitasato that blood serum taken from animals that had been rendered immune to tetanus and diphtheria was capable of curing other animals suffering from those diseases. Drs. G. and F. Klemperer (*Berliner klinische Wochenschrift*, Aug. 24 and 31, 1891) publish a research carried out in regard to pneumonia, with the object of discovering how immunity against the pneumococcus could be best produced, whether recovery from the disease rendered an animal immune, and whether it was possible to cure pneumonia by the blood serum of animals that have recovered from the disease. Their experiments, which were confined to rabbits, revealed that every nutrient medium in which the pneumococcus has been cultivated will, if inoculated, render an animal immune against pneumonic septicæmia, even after the cocci have been removed by filtration. The power of producing immunity is more speedily acquired, and is increased if the infected nutrient medium (before or after removal of the cocci) is exposed to a temperature of between 41° and 42° C. for two or three days, or of 60° for an hour or two. In every case, however, it was found necessary that some interval (varying from three to fourteen days) should elapse between the inoculation and the production of immunity. Hence it was too late to cure a diseased animal or even to prevent the onset of an attack if the injection was given simultaneously with the outbreak of the disease. On the other hand, serum taken from animals enjoying immunity was found able, especially when introduced directly into the circulation, to cure pneumonic septicæmia. The serum was injected twenty-four hours after infection, while the animals had a febrile temperature of between 105° and 106.5° F. Eight cubic centimetres were injected, with the result that the temperature gradually sank during the next twenty-four hours. In twelve successive cases a successful result was obtained. This research therefore confirms, in regard to pneumonia in rabbits, what Behring and Kitasato did for tetanus and diphtheria. Drs. Klemperer next studied the question how the blood serum of an immune animal cures an attack of pneumonic septicæmia, and discovered that when the pneumococcus is introduced into the body of an animal it generates a poisonous substance which can be isolated, and to which the name of "pneumotoxin" has been given. This pneumotoxin sets up a febrile condition which lasts several days, after which another substance is found to have been produced called "antipneumotoxin," which is able to neutralize the pneumotoxin. The serum taken from an immune animal contains this antipneumotoxin, and it is by means of this substance that it cures an attack of pneumonic septicæmia in other animals. The relation of pneumonia as seen in rabbits with that met with in man was next investigated, and the conclusion arrived at that the disease in both cases is produced by the pneumococcus, but that the human body is much less susceptible to the latter than the rabbit is. Thus it was found that serum taken from pneumonic patients after the crisis could cure pneumonia in rabbits; moreover, pneumotoxin and antipneumotoxin were found to be present in human serum as in that taken from rabbits. The crisis of pneumonia, according to Drs. Klemperer, takes place as soon a antipneumotoxin is produced in sufficient quantity to neutralize the pneumotoxin. Why immunity against further attacks lasts so short a time in man is still uncertain, but possibly less antipneumotoxin is formed in man than in rabbits in proportion to the pneumotoxin. Some attempts have already been made to cure patients suffering from pneumonia with the help of antipneumotoxin, but further observations are necessary.

— It is a well-known fact that, with the same temperature by the thermometer, one may have, at different times, a very different feeling of heat and cold. This varies with the temperature of the skin, which is chiefly influenced (according to M. Vincent of Uccle Observatory, Belgium), by four things: air-temperature, air-moisture, solar radiation, and force of wind. M. Vincent recently made a large number of observations of skin-temperature in the ball of the left hand, and constructed a formula by means of which the skin-temperature may be approximately deduced from those four elements. He experimented by keeping three of the four constant, while the fourth was varied, and a relation could thus be determined between the latter and skin-temperature. One fact which soon appeared was, that the relative moisture of the air has but little influence on skin-temperature. It was also found that for every 1° C. of the actinometric difference (excess of black bulb thermometer) the skin-temperature rises about 0.2°; and with small wind-velocities, every metre per second depresses the skin-temperature about 1.2°. In testing his formula M. Vincent found, with cold or very cold sensation, considerably greater differences between the calculated and observed values than in other cases. This he attributes to the great cooling of the relatively small mass of the hand. Taking the cheek or eyelid the results were better, says *Nature*.

— Last winter, in December and January, M. Chaix made a number of observations of the temperature of the air, the snow, and the ground at Geneva, of which he has given an account to the Physical Society there. He observed the air at four different heights; granular, pulverulent, and bedded snow, on the surface and at different depths; and the surface of bare ground as well as of ground covered with snow. There was no difference in mean temperature between the air at one and two metres; and very little between the former and that on the snow surface. The surface of the ground was 4.265° C. warmer than the surface of the snow (0.13 m. above), through arrest of radiation. But the bare ground was not cooled so much as the snow surface, and it was only 2.04° colder than the snow-clad ground. This shows the frigorific influence of snow on climate. Air passing over bare ground would have been 2° warmer than if it passed over the snow. The snow surface was sometimes warmer, sometimes colder than the air one or two metres above. In the dry winters of Siberia and Sweden, the snow-surface is generally (according to Woeikof) much colder than the air. M. Chaix explains the variations observed at Geneva by fluctuations in the relative humidity, involving alternate vaporization and condensation at the snow-surface. In two-thirds of the cases, indeed, abnormal cooling of the snow corresponded with a low humidity, and heating with a high humidity, and often formation of hoar frost at the surface, according to *Nature*.

— An illustration of the height of breaking waves is afforded by the following paragraph, which we take from the San Francisco *Chronicle* of Jan. 6: "Portland, Jan. 5 The lighthouse tender 'Manzanita' reached Tillamook Rock Sunday for the first time in six weeks, and brought away the keeper, George Hunt, who has been on the rock for four years, and has been transferred to the Cape Mars Light. He says, in the storm of Dec. 7 the waves swept clear over the house, washing away their boats, and tearing loose and carrying away the landing platform and tramway, which were bolted to the rock. On the 29th the waves were still higher, and streams of water poured into the lantern through the ventilators in the balloon top of the dome, 157 feet above the sea-level. The lighthouse was shaken to its foundation by the impact of seas against it, and the water found its way into the house. Men were on duty all night to keep the lamp burning, and but for the wire screen the shutters of the lantern would have been demolished."

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LATEST DETAILS CONCERNING THE GERMS OF INFLUENZA.

DR. R. PFEIFFER, overseer of the scientific division of the Institute for Infectious Diseases at Berlin, has the credit of discovering, isolating, describing, and inoculating the germs that are the cause of influenza. The following results are based upon his thorough investigation of thirty-one cases of influenza, in six of which autopsies were made.

1. In all cases there was in the characteristic, purulent, bronchial secretion a definite kind of bacillus. These rods were shown in uncomplicated cases of influenza, in an absolutely pure culture, and for the most part in large numbers. Very frequently they lay in the protoplasma of the pus-cells. Where the patient has been subject to other bronchial troubles, one finds in the sputum, in addition to the influenza bacilli, other micro-organisms. The bacilli can enter from the bronchi into the peri-bronchial tissue, even to the surface of the pleura, where in purulent coats in two autopsies they were found in pure culture.

2. These rods were found only in influenza. Numerous control-experiments showed their absence in common bronchial catarrh, pneumonia, and phthisis.

3. The condition of the bacilli varied with equal force in the course of the disease; first with the exhaustion of the purulent bronchial secretion the bacilli also disappeared.

4. Two years ago, at the first appearance of the influenza, I saw and photographed the same bacilli in large numbers in preparations of sputum from influenza patients.

5. The influenza bacilli appear as small rods, of about the thickness of septicæmia bacilli in mice, but one-half their length; frequently three or four bacilli are found arranged one after the other like in a chain; it is difficult to stain them with the basic aniline dyes; one obtains better preparations with Ziel's solution and with the hot methyline blue of Löffler. In this way one sees almost regularly that the end-poles of the bacilli stain more intensively, so that forms arise which might be very easily mistaken for diplococci or streptococci. The bacilli are not stained by Gram's coloring matter; and in hanging drops they are immovable.

6. These bacilli can be obtained in pure cultures; in one and a half per cent sugar-agar the colonies appear the smallest. The continued culture in this nutrient medium is difficult, and I have not been able to go beyond the second generation.

7. Many experiments for transmission to apes, rabbits, guinea-pigs, rats, pigeons, and mice were made. Positive results could be obtained only in apes and rabbits. The other species of animals were refractory to the influenza.

8. These results justify the conclusion that the above described bacilli are the cause of influenza.

9. Infection comes very probably from the germs of the disease in the sputum; and therefore for prevention of contagion the sputum of influenza patients must be made innocuous.

Dr. Kitasato has succeeded in cultivating the bacilli of influenza to the fifth generation upon glycerine-agar.

ARTHUR MACDONALD.
Georgetown Medical School, Washington, D.C.

A SERIES OF ABNORMAL AILANTHUS LEAFLETS.

A STURDY trumpet creeper (*Tecoma radicans*) has entwined itself about an ailanthus tree which stands in our yard, near the veranda. Together, they form quite a charming bower during the summer time, when the bright trumpet flowers are so profusely intermingled with the dark green foliage of vine and tree.

It was here that I had taken my chair one afternoon, to enjoy an hour's undisturbed reading. My anticipations of quiet, however, were very soon interrupted, by a sudden gust of wind, which set the leaves of my book a-fluttering so, that I was obliged to close it. But "it is an ill wind that blows nobody good," I said to myself, as I stooped to pick up some leaflets which came fluttering down from the ailanthus tree.

Although it was only June, these leaflets were of a bright yellow color, like the tints of early autumn. But what attracted my attention especially was their variation from the typical form. Every leaflet had a peculiar notch, lobe, or lop-sided outline which would cause it to be classed among monstrosities, or abnormal leaves. These abnormal specimens were more to me, however, than mere "freaks of nature." They were the tablets on which their own history was inscribed.

If we take one of the large ailanthus leaves, with its long rachis and numerous leaflets, we are led to inquire into the manner of its numerical increase of leaflets. At a cursory glance at the leaves we find that although the vast majority are odd-pinnate, there are many which we are scarcely justified in calling odd, nor yet should we denominate them even pinnate. That is, transition stages between odd and even pinnate quite commonly occur, and I would call these "abnormal leaves" transition stages. They are the keys which will unlock for us the mystery of their development. Let us see if such is not the case: let us make use of these keys and thereby learn whether such is not the verdict rendered by the leaves themselves. We will put our queries to the terminal leaflets, because they seem to be the centre of evolutionary activity in nearly all pinnate leaves.

We have quite an advanced transition stage in Fig. 1 of our series; it has quite a conspicuous projection beyond the typical outline on the left side; a prominent vein is seen extending to the apex of this abnormal projection, from which

on the lower side, lead smaller, well-marked veins. There is also a very slight point on the opposite side of the leaflet, the venation here being similar to that just described What, then, does this abnormal leaflet mean? Can we not see that nature has decreed that there shall be an increase in the number of leaflets? And that she is about to "cut off" new leaflets from each side of this terminal leaflet?

Fig. 2 confirms us in this supposition, and furnishes an objective demonstratian of a more advanced transition stage. The sinuses have deepened, and the two lobes bid fair to become separate individual leaflets. We feel secure in making this statement because Fig. 3 stands ready to make good our word with a newly-added leaflet on one side and another on the other side, well under way. The rachis, meanwhile, has elongated to make room for the new-comer. Fig. 4 illustrates a repetition of this process of division, adding emphasis to our explanation of these "abnormal leaves." Nature is going right on, bent upon working out her conceptions to the fullest extent.

Nos. 5, 6, and 7 are certainly extremists. They may, perhaps, be compared with the impulsive, rampant reformers in the social world, who are imbued with a stronger progressive impulse than will harmonize with existing conditions; whose wishes to surmount all obstacles and soar aloft lead judgment and reason astray. The time is not ripe for

LEAFLETS FROM THE AILANTHUS TREE.

such prodigious strides, and much effort is therefore expended to little purpose. A few such leaders will occasionally be found among plants, fore-runners, as it were, of future attainment, and here we have leaflets which as yet have not even attained to an individuality of their own, taking upon themselves the work which legitimately belongs to the senior members of the family; if we may designate a leaf as a little family, and the leaflets thereof the individual members. No. 8 is such a senior member; that is, instead of a terminal leaflet it is from the base of the leaf. It is better able to take up the burden of secondary division than the mere baby leaflets that have not yet learned to take care of themselves. No. 8, however, may also be classed with the reformers, but with that more reasonable class who are not entirely beyond the ken of normal vision.

Would we not, therefore, be led to draw this conclusion from what we have said (and, I trust, demonstrated), that pinnate leaves are developed by a division of the terminal leaflet: the bi-pinnate leaf is evolved from the pinnate by the division of the leaflets, normally beginning in the lower or basal leaflets? That this is the law of division which holds among the majority of pinnate leaves is quite commonly demonstrated and verified by the leaves of various plants. The leaves of the trumpet creeper furnish as good illustrations of these various stages of transition as the ailanthus leaves.

There is but a slight point on the lower or outer portion of the typical basal leaflet of the ailanthus; this point is crowned with a small gland; here seems to be the starting-point of the new departure, which, according to the prediction of No. 8, will, in the course of time, result in the evolution of a bi-pinnate ailanthus leaf. This secondary division, as we have chosen to call the division of the lower leaflets, is illustrated abundantly by the common elder (*Sambucus canadensis*). So conspicuous, indeed, are the variations in the elder that it deserves a chapter on its own progressive efforts; it seems especially able to respond to favorable conditions.

MRS. W. A. KELLERMAN.
Columbus, Ohio.

SUGGESTIONS AS TO TEACHING BOTANY IN HIGH SCHOOLS.

THE teaching of botany in our colleges and higher schools during the last twenty-five years has had the unfortunate effect of bringing the science into disrepute, and of engendering in the minds of many who — as they would say — "took" it (like a dose of medicine), a thorough distaste for it. It is only within ten years that any radical change has taken place in the teaching ideals, and even to-day in many of the best institutions of learning, conservatism forces instruction into the old channels. The lower schools have travelled the same line, partly because they knew no better way, and partly because they were meeting the demands of the higher schools in the matter of preparation.

The radical defect of the older teaching lay in the failure to study the plants themselves; in the failure to treat them as living organisms; and in the failure to take into account the existence of other plants than the flowering ones. The ease with which plants could be collected and preserved by drying early led to the study of their external characters with a view to their classification alone. From the earliest times, therefore, almost to the present day, classification has been looked upon as the most important portion of the science of botany. Now, however, that the economic importance of the study of the physiology of healthy and diseased plants and of the causes of disease is coming to be more generally appreciated, it is high time that both in primary and secondary schools those portions of the science be taught which have a vital and vitalizing interest.

What Text-Book Shall We Use?

The first question that is usually asked is, "What text-book shall we use?" It is a difficult question to answer, and probably the best reply is, "Whatever text-book the teacher can use best." There is no book known to me which presents the subject in just the way that I consider most important. Probably the one of most general adaptability is "Gray's Lessons in Botany." If the teacher is capable of using them, either Bessey's "Essentials of Botany" or Campbell's "Structural and Systematic Botany" may be recommended. Wood's "Lessons in Botany," revised, is unfit for use on account of the numerous and misleading blunders which it contains. There should be in the school library, for reference, Gray's "Structural and Systematic Botany," Goodale's "Physiological Botany," Bessey's "Botany," and Goebel's "Outlines of Classification." Miss Newell's "Outline Lessons in Botany" will be found suggestive to the teacher who knows nothing of the method of study suggested herein.

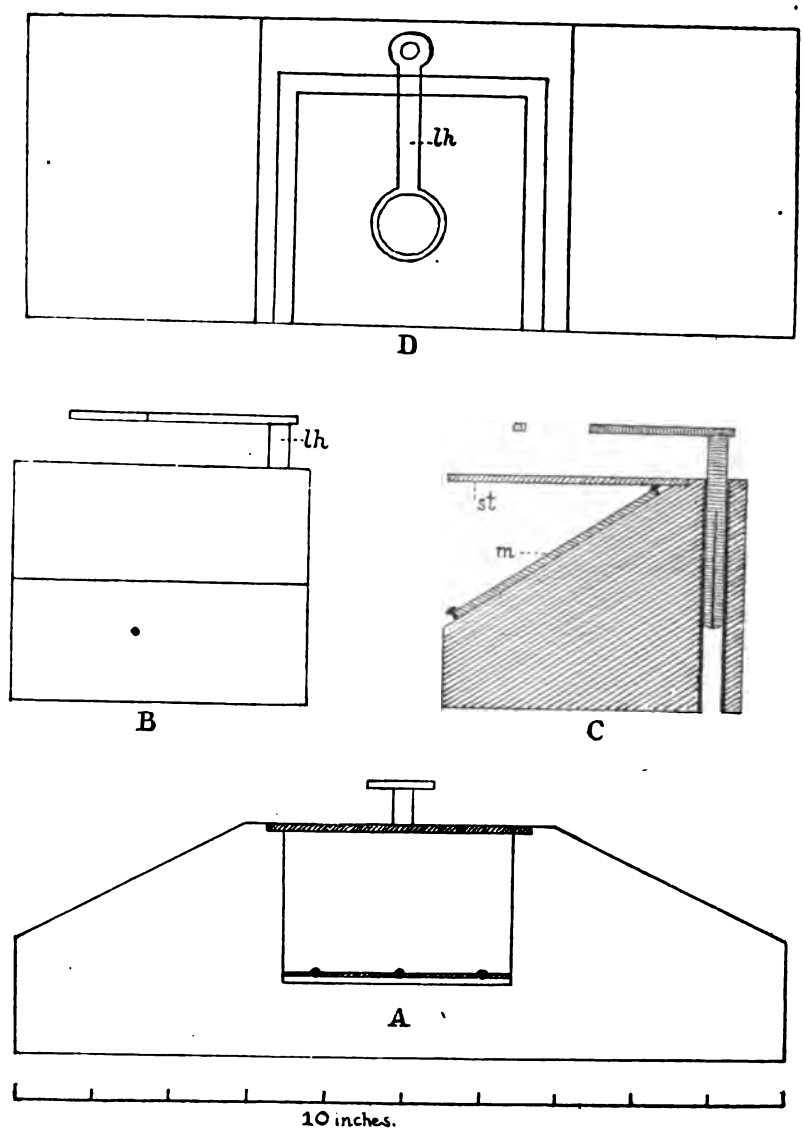
The suggestions here made are based on the supposition

that the scheme of studies proposed by the State superintendent is accepted, in which two terms are assigned to botany, beginning in the winter term. It is also presupposed that the School Board will be willing to supply the pupils with a proper room and a small amount of apparatus. I consider the providing of these quite as indispensable for the study of botany as furnishing a recitation room for mathematics with a blackboard and its accessories.

The room should be furnished with a sufficient number of common kitchen tables (those with unfinished tops are best), at which two students can work comfortably, and even four if crowded. The more windows the better.

The apparatus required is simple. Simple lenses with some device for supporting them while the hands are used in dissecting are needed The figures annexed show a most effective and low-priced dissecting stand which is in use in the University of Wisconsin and is to be preferred to more expensive ones. The block can be made by a carpenter for a few cents; the plain and mirror glass can be procured at the glazier's; the lenses and lens holders can be procured from the Bausch & Lomb Optical Co., Rochester, N.Y. The total cost should not exceed $1.75 If preferred, they may be procured of Mr. L. S. Cheney, Madison, Wis., at $1.75 for single stands, with a discount of ten per cent on orders for ten or more.

A deep individual butter dish is necessary for examining specimens in water. Each student should have a pair of needles (No. 6, "sharps") with the eye-end driven into soft pine handles. This can be done by holding the needle with a pair of pliers and forcing it in. The pupil should be required to provide himself with a sharp-bladed pen-knife, a rarer article than might be supposed.



DISSECTING MICROSCOPE.

The body is a solid block of clear pine, cut as shown in *A*, front view; *B*, end view; *C*, median cross section; *D*, top view. *lh*, lens holder, which slides in brass tube driven into a hole in block (sec. *C*.); *st*, stage, a movable glass plate; *m*, mirror, fastened with small screws or tacks.

How to Get Material.

I should begin with a study of the flowering plants. There will be room for the exercise of some ingenuity in getting pupils to provide proper material for study by raising some and collecting some. Lima beans, sunflowers, and corn can be grown in pots or boxes; window gardens, greenhouses, and provision stores can be levied on until the spring opens. But it is better to have material collected in the summer and preserved in alcohol. Such material should be studied in water to prevent drying and to remove brittleness.

How to Begin.

It matters little what part is selected for a beginning. As the study commences in winter, the shoots of trees, two or more feet long, may be used. Select a tree in which the scars left by the fall of the foliage, leaves, and bud scales of the preceding season are quite conspicuous, such as the cottonwood, poplar, hickory, or horse-chestnut. Set the students at work to examine these before they have been assigned any study in the book. Have them examine all the markings they can find; compare the buds; study the relation between the buds and the scars; determine the extent of the preceding season's growth and of the season before that. When as much of the external anatomy has been seen as possible, let them carefully dissect the buds, studying the nature and shape of the scales; the character of their surfaces, whether hairy or resinous; the young foliage leaves for the next season; the young stem, comparing the shoot for the coming season with last season's growth, noting differences and resemblances. This dissection should be made partly by tearing off the parts, partly by cutting thin slices crosswise and lengthwise with the knife.

When the students have seen everything that they think there is to be seen, let them write a description of what they have observed. They should be asked to make this description as terse as possible, using their own language and not resorting to the book for terms.

The teacher should then examine these descriptions, in which he will doubtless find much omitted. I should then make the study of the same shoot the subject of the next class exercise, in which I should point out each feature that I wished examined, giving sufficient time for the inspection of each part. I should also endeavor to show that for the circumlocutions in their descriptions there are often single words (technical terms). The pupils will thus come to know something of the method of accurate and thorough observation, and will discover that technical terms are not hard words invented for their discomfiture, but short ways of expressing the ideas gained.

At the close of this exercise I should call upon each pupil to draw carefully a portion of the shoot showing as many of the facts observed as possible. Drawings should also be made of the dissected parts. Here the teacher will be met by the objection on the part of the pupils that they cannot draw; but as that is only another way of saying that they cannot see accurately, he will have to insist on their doing the best they can, with the assurance that as power of accurate observation increases the accuracy of the drawings will increase in the same ratio. He should be able to lead here as at other difficult places. Happy he if he be not a blind leader of the blind.

After studying several other shoots in the same way, I should assign the lesson in the text on buds and branching.

The points specially emphasized here are: 1. Study of the plants themselves. 2. Drawing and describing observations. 3. Afterwards the study of the text-book. 4. Supplementary reading, particularly as to the function of the parts studied.

Topics for Further Study.

Following this method with each organ, the following topics are suggested:

Underground stems: potato (tuber); onion (bulb); cyclamen or Indian turnip (corm).

Structure of stems: cut thin slices of both herbaceous and woody stems and examine in water. Bean, sunflower, geranium, hyacinth, and twigs of forest trees may be used.

Leaves: structure of blade and petiole; forms of stipules; character of venation, particularly with reference to function of veins. Reference readings on the function of foliage leaves are particularly important. Study of the unfolding leaves in spring is specially desirable.

Flowers: parts; forms; flower clusters, etc. I need enter on no details as to these parts, since they are treated so fully and have always received overmuch attention because of their importance to classification.

Let it be remembered in the study of all these topics that it is not a memorizing of the technical terms of descriptive botany that is wanted, but a study of structure of the parts with reference to function. Insist on the pupil constantly asking himself, "What is this for?" As to technical terms; if they are not acquired as a convenience they would better not be acquired at all.

Some time should be taken before the close of the year to study the lower plants. It is an excellent plan in the spring to organize "forays," on which pupils can collect every form of plant they can lay their hands on, ferns, toadstools, lichens, parasitic fungi, algæ, etc. Preserve these[1] and have them studied. Directions for such study can be found in Arthur, Barnes, and Coulter's "Plant Dissection" (Henry Holt & Co.); Bower's "Practical Botany" (Macmillan & Co.); Bessey's "Essentials of Botany" (Holt); Campbell's "Structural and Systematic Botany" (Ginn & Co.).

Questions will be freely answered regarding any matters not elucidated above, and further suggestions will be made if desired. I should be glad to be of assistance to teachers in improving the work in botany.

CHARLES REID BARNES,
Professor of Botany in the University of Wisconsin.

A NEURO-EPITHELIOMA OF THE RETINA.[2]

THE possibility of the reproduction of the most highly organized structure of the human body has long been doubted and even denied. Until the publication of an instance by Professor Klebs of Zurich, in which the ganglionic cells of the central nervous system were found repeated in a tumor formation, this was not admitted to be possible. Even now not a few competent pathological histologists are not convinced of its occurrence. An interesting and important addition to this subject is that of Dr. Flexner. In this instance the rod and cone layer and the external nuclear layer of the retina were reproduced in a tumor.

The case was that of a child four months old. One eye was affected and removed, and then the remaining eye became the seat of a disease presumably of like nature. But nothing was permitted to be done for the second eye. Several years before this child was born another child in the same family, this one six months old, died in consequence of an eye tumor which returned. Two years after the case just related another child of the same parents, this one four months old, had a tumor of the eye which spread to the brain, also resulting in death. The one which is reported makes, therefore, the third instance of eye tumor in this family. There was no history of eye tumor in the immediate ancestors of the children.

The vitreous chamber of the eye was filled almost entirely with the growth, The latter was attached to the retina throughout a considerable part of its extent, and was seen to originate at a point of microscopical size situated in the external nuclear layer. The cells which made up the tumor consisted of two principal kinds.

[1] Every teacher should have some book with directions for preserving plants. The following are available: Bailey's "Collector's Hand-book" (Bates, Salem, Mass.); Penhallow's "Botanical Collector's Guide" (Renouf, Montreal); Knowlton's "Directions for Preserving Recent and Fossil Plants" (Part B, Bulletin 39, U. S. National Museum).

[2] "A Peculiar Glioma (Neuro-epithelioma?) of the Retina," by Simon Flexner, M.D., fellow in pathology. From the Pathological Laboratory of the Johns Hopkins University and Hospital. The Johns Hopkins Hospital Bulletin, No. 15, 1891.

Those present in predominating number are probably not the entire cells, but are described as such for the sake of brevity. They present the appearance of sharply stained nuclei, with scanty, often indistinct, even apparently absent, cell bodies, and in favorable places their fibre-like processes can sometimes be traced a short distance from the cell bodies. These bodies often appear as round cells, and they are spoken of as such in this article, but they have a more complicated structure than this designation would imply. The next most important cells are larger than the round cells, but their nuclei are not larger than those of the round cells. These cells are usually of a columnar or rod shape, but sometimes they appear to be conical. The nuclei invariably occupy the broader ends of the cells, and each cell presents opposite to the nucleus an acute terminal process. Finally, from the extremity of the cells can sometimes be seen a stalk-like prolongation which passes down between the round cells and probably becomes united with them. The disposition of the various cells of the tumor is important. The columnar cells arrange themselves in the form of circles or rosettes, and this is accomplished through the juxtaposition of the sides of the cell bodies, the acute ends of the cells pointing towards the centre of the circle, while the periphery is formed by the broad ends of the cells containing the nuclei. The latter vary in size, depending on the number of cells concerned in their formation, and where the acute ends of the cells are in opposition, and just before their termination, a very fine, although distinct, membranous ring is formed, and projecting beyond this ring the delicate processes of the cells forming their acute ends may be observed. The round cells above described surround the rosettes. These tumor cells are in many ways identical in appearance with the external nuclei and rod and cone layer of the retina, as the author shows.

"If morphologically it is impossible to distinguish between the round cells of the tumor and the cells of the external nuclear layer of the retina, so do we consider that in each of the numerous rosettes can be seen the rod and cone layer of the retina reproduced in miniature. For it is possible to see in the membranous ring the external limiting membrane of the retina, beyond it, projecting into the lumen of the rosettes, the delicate processes of protoplasm corresponding to the rods and cones, and opposite to these the nuclei to which these processes are united And then surrounding these nuclei, which form a part of the external nuclear layer, as it were, are the numerous round cells which are indistinguishable from the cells of the external nuclear layer. It is not to be considered that in every rosette the matured rod and cone layer of the retina is reproduced· While this is the case in some of them, others show a structure suggesting the embryonic type. Hence this tumor is regarded as one in which the two most external layers of the retina have been reproduced."

The second part of the paper is devoted to a discussion of applicability of the term "glioma" and the suggestion of the name "neuro-epithelioma," and then with a consideration of the question of the embryonic origin of tumors in general.

A SEEDLING BLACKBERRY PLANT.

WHEN poor little "Jo" of Bleakhouse was told to "move on," he did not appreciate the fact that everything in nature is impelled by irresistable forces to "move on" to a higher plane of existence, or suffer the only alternative, extinction. Plants and animals must be able to respond to changed conditions, must adapt themselves to their ever changing environment by various modifications.

Grant Allen has written some exceedingly interesting chapters on the genealogy of certain plants. Nature seems to have dropped a magic key into his hands, which admits him directly into her presence, and he relates with charming grace what she imparts to him. Although it requires a skilled expert to "Dissect a Daisy," any one who will, may read the fascinating story of evolution which is written on the leaves of many plants.

Now, here is a little seedling blackberry plant, which we will take for our text. You will notice at the merest glance that the leaves are quite dissimilar. The one nearest the base being simply a plain, ovate leaf, with an irregularly serrated margin. I wish you to notice particularly a certain peculiarity in the venation of this leaf, viz., that the first pair of veins near its base are quite prominent; that, leading from these veins on the lower side, are also well-marked veins; while on the upper side there are none, or very inconspicuous ones. There does not seem to be anything striking or of especial interest in these facts, but, like the "magic pear," which the artist, with a few strokes, converts into a face, this peculiarity becomes gradually emphasized, until later on in the series it may be called a characteristic.

The second leaf differs somewhat from the first one, the outline is more irregular. If, however, we read just a little between the lines, we will see that it really has taken quite a stride in advance; a little more careful examination will reveal, what perhaps escaped our notice at first, that the difference between these two leaves does not consist wholly in difference of outline. Again, it will be observed, the

A SEEDLING BLACKBERRY PLANT.

pair of veins near the base of the leaf are prominent, the smaller veins leading from them being also well-marked, on the lower side only.

With a little imagination, we can perceive that Nature is busy at work with this "magic leaf," and has already conceived the idea of evolving from it the trifoliate leaf. With this idea in mind, we can readily understand the significance of the prominent veins, to which your attention has already been called. We may consider them the frame-work of the undeveloped leaflets. A notch is quite plainly seen on each side of this second leaf, which nature evidently wishes to continue and deepen until a new leaflet is given off on either side. As if to render this result more easily accomplished, she has omitted the frame-work in the portion of the leaf where division is to take place. As proof that our imagination has not led us astray in our prediction as to nature's plan, we have leaf No. 3 of our seedling. This leaf has actually given off a leaflet on one side, and is evidently husbanding its forces for the elaboration of another on the opposite side, the outline of which is already suggested by the characteristic venation on the lower or outer portion. We may almost say that half the leaflet is even now evolved.

Nature had these little leaflets in mind long before she brought them forth, as shown by the veins on the first leaf of our little seedling.

But let us return to the perfect leaflet, which has been given off and now enjoys the responsibility of individuality. Observing it carefully, we discover that nature has planned a repetition of the process of division. Leaf No. 4 demonstrates the progress of this conception. The new leaflets can be readily perceived, though they yet live with the mother leaflets, if we may so designate the latter, which continue to elaborate nourishment for their offspring until they no longer need direct parental care.

In leaf No. 5, nature has almost reached the highest type of blackberry leaf of the present. In it, the fifth leaflet is about to bid adieu to its mother-leaflet; it stands on the threshold of individual existence; soon it will reach maturity and have a petiole all its own. The truth of this assertion is demonstrated by leaf No. 6, which represents a normal blackberry leaf, with five fully developed leaflets.

Nature never does anything in a hurry. Whether it took ages or æons to evolve the five leaflets from the single leaf we do not know, but he who runs — through a blackberry patch — may read on every plant or bush some chapter of the story of evolution she has written on the leaves. The single leaflet will not be met with so commonly, but various stages of transition, from three to five leaflets may be found on any blackberry plant.

Agassiz insisted that the laws of geological succession and embryonic development are the same, that embryology, or the development of the individual, is an epitome of the development of the entire series. In the leaves of the seedling blackberry we have, as it were, an epitome of the evolution of the blackberry leaf from the ancestral form to the present type.

The social world is sometimes disturbed and startled by the appearance of a reformer, who casts from him superstitions, dogmas, old beliefs, and mounts to a higher mental plane. So, too, there are reformers among plants; for instance, a blackberry leaf of six or seven leaflets is sometimes found; it is true such leaves are considered monstrosities, or abnormal specimens.

If we again permit ourselves to read between the lines, will we not be able to see in these abnormal leaves that nature is at work now as in the past? Favorable conditions and hereditary influence are now, as formerly, the tools she furnishes her favorites for working out their evolution.

The trifoliate leaf existed in embryo, as it were, in our ancestral seedling leaf. Nature said, "Move on!" When the whole brotherhood had reached the dignity of the perfect trifoliate leaf, she bade them still "move on!" All have not yet attained to the degree of progress represented by the five leaflets. But nature will continue to "move on," and the occasional reversions and reformers are the sign-boards which indicate to us the road she has taken.

MRS. W. A. KELLERMAN.

Columbus, Ohio.

NOTES ON THE FOOD OF THE BOX TORTOISE.

SEVERAL years ago, walking one morning in a wood in Pennsylvania, I surprised a wood turtle or box tortoise eating his breakfast. The season had been rainy, and many varieties of large fungus had attained a prodigal growth. The woods were full of what are popularly called toadstools; many of them were of the diameter of a tea plate, and stood five or six inches high. As I walked through the wood I observed that many of these fungi had been gnawed off evenly, as if cut by a knife, leaving only the central pillar intact. What had done this? I soon discovered, for moving noiselessly over the mossy earth, I came to a little opening, where grew one of the finest of these toadstools, and there was a wood turtle taking his breakfast.

The animal had already made one or two rounds of his plate, and was eating with praiseworthy deliberation. He would bite off a mouthful of toadstool, chew it carefully until he had extracted all the juice, then open his mouth and drop out the chewed fibre, and take a fresh mouthful, biting not inward toward the stem, but breaking off the morsel next beside that which he had just eaten. He paced round and round the fungus as he took his bites, eating his plate like Æneas and the other Trojans, and as the fungus decreased in regular circles the circle of chewed fragments increased. In three quarters of an hour he had eaten all the disk of the fungus to the stem part, and then he walked slowly off to look for another.

I found the crumbs that had fallen from his vanished table quite dry, nothing nutritious being left in them. Why he rejected the central part of the fungus and the stem I could not imagine, but he left it in every instance. If he came upon a decayed or wormy portion of the toadstool he did not "bite round it," but abandoned it altogether and went for a fresh one.

Last summer I took home with me a box tortoise to experiment on feeding it. He ate flies and other insects from my fingers at once, showing no signs of fear; he ate bread and milk with evident relish. I put a blackberry in his open mouth and he closed upon it, but at once, with every appearance of deep disgust, stretched his mouth wide open, and, taking his right front paw hand-wise, wiped all the berry from his mouth. He repeated this performance many times, both with blackberries and blueberries, always using his right paw to cleanse his mouth.

J. MCNAIR WRIGHT.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

Hypnotism among the Lower Animals.

THE power attributed to the snake and feline families, of "charming" their victims, seems to me past dispute. Is it not merely a form of hypnotism? Livingston tells us that when at one time seized by a tiger, he felt neither terror nor pain, all his senses seemed to be benumbed. Bates, in his "Naturalist on the Amazons," states that one day in the woods a small pet dog flew at a large rattlesnake. The snake fixed its eyes on the dog, erected its tail, and shook its rattle; it seemed in no haste to seize the dog, but as if waiting to put the dog into a more suitable condition for being seized. As to the dog, it neither continued the attack nor retreated, could not or would not move when called, and was with difficulty dragged away by its master.

I have seen one case of a snake charming a bird, but I had a better opportunity to study a cat charming a bird, and probably the process is much alike in both.

The cat placed itself on the outside sill of my window, near to a pine tree. A bird presently lit on the pine tree, no doubt not observing the cat. The cat fixed its attention on the bird. The cat's eyes were widely opened, and shone with a peculiar brightness; its head was raised and intent, the fur on its neck and about its face slowly stood up, as if electrified. Except for this rising of the fur, and a certain intensity of life in the whole attitude of

the beast, it was as still as if cut from stone. The bird quivered, trembled, looked fixedly at the cat, and finally, with a feeble shake of the wings, fell towards the cat, which bounded to seize it.

A lady tells me that she "does not believe that cats can charm birds, because she has seen a cat try to charm a parrot, and the bird, greatly alarmed, scolded loudly." This proves nothing, the parrot in general, or, more probably, that particular parrot, did not prove a good subject for the mesmeric power. I have seen people who cannot be hypnotized; they resent the effort, and nervous action becomes intensified. J. MCNAIR WRIGHT.

AMONG THE PUBLISHERS.

THE W. J. Johnson Co., limited, have ready "The Electric Railway in Theory and Practice," a complete treatise on the construction and operation of electric railways, by O. T. Crosby and Dr. Louis Bell, fully illustrated and wholly practical.

— Henry Holt & Co. will shortly publish a translation of "Geschfchte der Philosophie," by Dr. W. Windelband, professor in the University of Strassburg.

— Thomas Nelson's Sons have ready an entirely new atlas by J. G. Bartholomew, entitled "The Graphic Atlas and Gazetteer of the World," with over two hundred and twenty maps, charts, plans of cities, etc., all revised to present date, and a gazetteer of nearly 55,000 places and results of new census. Throughout the atlas the countries of the world have been treated with fulness in proportion to their commercial importance and interest. In the United States section a separate map is given of each of the States and Territories. The Canadian provinces are treated in similar detail. The maps have been specially compiled from the latest and best government survey maps, and have undergone local revision for the verification of new counties, townships, and railways. Considering the vast amount of information given, the atlas is a marvel of compactness and practicability.

— The most important work on the general study of linguistic science that has appeared in 1891 is that of Professor Georg von der Gabelentz, "Die Sprachwissenschaft, ihre Aufgaben, Methoden und bisherigen Ergebnisse," Leipzig (Weigel, publisher), pp. xx. and 502. The wide-reaching and comprehensive scope of this treatise is shown by the very title, and readers will soon see that the author fulfils what he promises. Through his great practical experience the author, well known as a connoisseur of eastern Asiatic languages, is enabled to give more hints about linguistic studies and their scientific bearing than such men as have confined their energies to inflective languages alone. The volume gives us the views of a man familiar with all possible types of human speech, the monosyllabic as well as the incorporating and agglutinative, and introduces us in the most fascinating way into all the morphologic intricacies of the verb, noun-verb, and sentence. In its make-up the book comes nearest the celebrated "Principles of Language History," by Paul, and supplements it in many different

ways, as it does also the works of Friedrich Müller and Whitney. There is no chapter in language-study which is not fruitfully hinted at or fully treated by the author: the composing of grammars, the analytic compared with the synthetic system, the various phonetic modes of recording languages, the medley languages, theory of roots, the tests of affinity, the possibility of composing scientific dictionaries, the analysis which is inherent in etymologic research, synonymic dictionaries, etc.

— Dr. Andrew D. White will open the March *Popular Science Monthly* with a chapter on "Astronomy" in his Warfare of Science series. The strenuous exertions made by both the Catholic and the Protestant clergy to suppress the teachings of Copernicus and Galileo are set forth in this article with such strong evidence as to admit of no denial or shifting of responsibility. "The Organ" will be the subject of the article in the American Industries series. The author, Mr. Daniel Spillane, describes some of the noted instruments in the United States, and shows that American organ builders have made good use of the scope for individuality which their art allows. The article is fully illustrated. Under the title "Social Statistics of Cities," the March number will have a paper by Carroll D. Wright, comparing the area and population, and the cost of each department of public works, in fifty cities of the United States. The comparison contradicts some prevailing opinions as to what cities have the most expensive governments. "The Cotton Industry of Brazil" will be described by John C. Branner, formerly assistant geologist of the Brazilian Geological Survey. Mr. Branner believes that the production and manufacture of cotton in Brazil is destined to increase, but that the country will not become a competitor of the United States in this industry.

— "Darwin after Darwin," is the title of a book that George J. Romanes is preparing.

SCIENCE

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SCIENCE

TENTH YEAR.

The use of *Science* by scientific men has increased in the past few months as never before. More than **two hundred of the leading scientific men and women** of America **have agreed to contribute** to the paper during the coming year; and, as others are constantly joining in this move, to make the paper more valuable than ever, it cannot be long before there will be a body of **five hundred competent users of this weekly medium of scientific discussion.** It is our aim to place the paper in the hands of all competent persons who will avail themselves of this opportunity to make *Science* a better representative of American scientific work than ever in the past.

N. D. C. HODGES, 874 Broadway, New York.

SCIENCE

NEW YORK, FEBRUARY 19, 1892.

NOTICE OF NEW GIGANTIC FOSSILS.

While on a collecting trip the past summer in the Bad Lands of north-western Nebraska and south-western South Dakota my attention was called by Mr. Charles E. Holmes

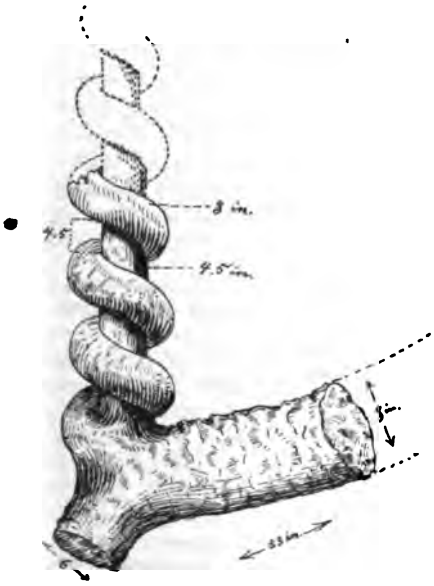

FIG. 1.—Devil's Corkscrew in the collection of C. E. Holmes. Drawn from nature.

(Yale, '84) to some gigantic fossils abounding in the extreme north-western corner of Nebraska. At that time I secured one large specimen, and noted and sketched several other forms, intending to return later and complete the work in that highly interesting field.

These fossils seem altogether so remarkable and of such imposing size and peculiarity of form, that I have felt great hesitancy in offering any suggestions as to what they are or in describing them at all; and what I now venture to publish is proposed tentatively, till I can return to this same spot and complete the work cut short last season. Not less than two genera and three species of the family were noted, and, because of their similarity to immense corkscrews, we dubbed them "Devil's Corkscrews," and I offer for them the provisional name *Daimonelix*. At least two gigantic and one small species were observed. They are almost mathematically exact and regular in form, and suggest a great three-inch vine coiled with strict uniformity of pitch about a four or five-inch pole. However, the vine and pole, as the cut will show, are just as much one as are the thread and screw which they so strikingly resemble. At the bottom of all is a transverse piece, indefinitely long, and about ten inches in diameter, rendering the appearance of the whole like that of the veritable corkscrew (See Fig. 1).

Just what this great "rizome" is, remains to be learned. In the mean time, suffice it to say, that, as far as observed, it consists invariably of a small obliquely descending portion, and a large obliquely ascending one. The latter, as shown by all that have been dug out, at least, seems to curve upward gradually, and ultimately reach the surface.

The great "underground" stem of my own specimen (Fig. 2) was followed from the wall of a small butte some ten feet straight into its interior, and then the work of further excavating in rock so very soft and crumbling, yet so peculiarly difficult to work, had to be abandoned. In the two remaining forms especially noted, one gigantic, the other small, the coil had the form and pitch of the common open corkscrew (see Fig. 3).

They covered an area of several square miles, where I saw large numbers of them, all standing in the incompletely lithified sandstone as erect as so many titanic hop poles with so many titanic vines coiled upon them. I estimated that many could not be less than thirty or more feet in height; at any rate, we frequently saw in the vertical walls of small cañons or draws fifteen feet of exposed corkscrews, while an unknown amount had been weathered from the top, and an indefinite amount was still buried in the rocks below. Then,

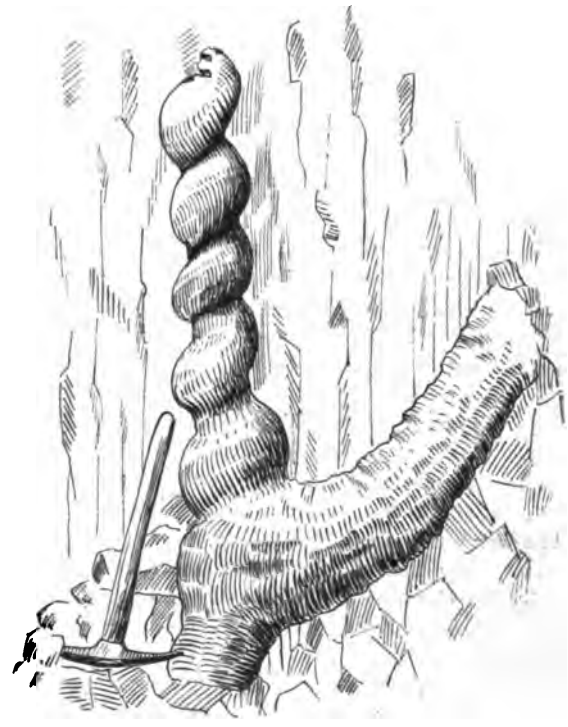

FIG 2.—A sketch of Devil's Corkscrew (in my own collection) as it appeared when nearly dug out of the vertical bank. Top eroded away. Height about five to six feet.

again, I dug out the basal portion of one specimen fully thirty feet below the surface, where the tip-ends of others were exposed. These strange forms seem to be casts, no structure being visible to the eye, or under the glass. The gray matrix readily weathers away from the specimen, which on fracture shows a spongy, friable, white wall, surrounding a core or matrix; though of chalky appearance, the wall is strictly silicious.

While reminding one forcibly of some monstrous fossil bryozoan, it seems improbable that it is such, neither is it a plant, nor a mollusk, as I believe. Possibly it is the case of some ancient worm. I have shown the specimen to eastern as well as western geologists and botanists, besides sending drawings and descriptions of it to others, who pronounce it entirely new to them. As far as my own experience goes, I have neither seen anything of the kind in any of our large eastern museums nor have seen anything published relating

FIG. 3. — Diagram of another form of Devil's Corkscrew, as sketched in the field.

to it, and I feel reasonable confidence in offering a notice of what I believe to be a new paleontological specimen, trusting that, if nothing more, it may elicit information on the matter from anyone who has it to offer.

IRWIN H. BARBOUR.

CONFIRMATION OF THE DISCOVERY OF THE INFLUENZA BACILLUS.

To Dr. Pfeiffer of Berlin is due the discovery of the influenza bacillus. Dr. Kitasato has cultivated it to the fifth generation. Koch has shown, in an article not yet published, how pure cultures of tubercle bacilli can be obtained directly from the sputum. Kitasato has succeeded in employing the same method with the influenza bacilli. According to him, the single colonies are so uncommonly small that they can be easily overlooked, so that former investigators may have failed to see them. The colonies do not flow together as in other kinds of bacteria, but always remain separated; this is so characteristic that the influenza bacilli can be distinguished from all other bacteria with certainty.

The same bacilli have been found in the blood of influenza patients by Dr. Canon. Dr. Koch has compared these with the micro-organisms discovered by Pfeiffer, and pronounces them identical.

And now Dr. Canon has gone still further,[1] and has succeeded in cultivating the influenza bacillus from the blood of patients attacked with the disease. The cultivation is especially difficult since the bacilli in the blood-drops are very few in number, and the colonies, on account of their fineness, are concealed through the coagulated blood. The blood therefore was not inoculated in tubes upon glycerin or sugar-agar, but in the Petrian "Schalen." A great quantity was employed. By this method there was not only a greater probability of preserving colonies, but also the possibility of eventually seeking out the colonies with the microscope.

The blood is taken in the following manner: a finger-tip is cleansed with sublimate, alcohol, and ether in the usual way; then with a red-hot needle the finger is pierced; an assistant presses the blood out of the opening in drops, being careful that they remain globular in form; from eight to twelve drops are placed upon the Petrian "Schale," and they are heated in a temperature of 37° C. The colonies show a slight development after twenty-four hours; in forty-eight hours they are distinctly seen. They are like those cultivated by Pfeiffer from sputum of influenza patients. In the cultures from the blood the colonies often lie close upon one another. The pure cultures from these colonies have the same appearance as those Kitasato has described.

Dr. Canon cultivated influenza bacilli from the blood of six patients, and in all the bacilli in the blood preparation were few in number and separated. And thus it appears that in those cases where the bacillus is wholly separated in the blood preparation, a sure diagnosis of influenza is given.

A. MACDONALD.

Georgetown Medical School, Washington, D.C.

[1] Deutsche Med. Wochenschrift, Jan. 21, 1892.

NOTES AND NEWS.

THE University of Edinburgh in June, 1891, conferred upon Professor Simon Newcomb the honorary degree of doctor of laws (*in absentia*). Professor Newcomb was also elected, in June, 1891, an honorary member of the Royal Institution of Great Britain.

— At a meeting of the trustees of Johns Hopkins University, Dec. 15, 1891, it was determined to proceed to construct an academic hall on the property belonging to the university, at the corner of Monument and Garden Streets, running back to Little Ross Street. The trustees are enabled to take this important step by the gift of the late John W. McCoy, who made the university his residuary legatee. Sufficient funds have been received from his estate for the erection of a building which will furnish rooms for the classes in languages, history, and philosophy, with space for the present requirements of the library, and an assembly-room which will hold over six hundred persons. The trustees voted that the building should be known, in honor of the munificent donor, as McCoy Hall. The piece of ground on which the new hall is to be constructed is 100 × 185 feet, and is now taken up with residences used for purposes of the university. Messrs. Baldwin and Pennington have been selected to draw up the plans for the building.

— On 12th of May, 1890, while making a professional call in the outskirts of the town, B. H. Hartwell, M.D., of Ayer, Mass., was summoned into the adjacent woods by a messenger, who stated that her mother was "burned alive." In a paper read before the Massachusetts Medico-Legal Society, and published in the *Boston Medical and Surgical Journal*, Dr. Hartwell says: "Hastily driving to the place indicated (about forty rods distant) a human body was found in the actual state of conflagration. The body was face downward; the face, arms, upper part of the chest, and left knee only touching the ground; the rest of the body was raised and held from the ground by the rigidity of the muscles of the parts. It was burning at the shoulder, both sides of the abdomen, and both legs. The flames reached from twelve to fifteen inches above the level of the body. The clothing was nearly all consumed. As I reached the spot the bones of the right leg broke with an audible snap, allowing the foot to hang by the tendons and muscles of one side, those of the other side having burned completely off. Sending my driver for water and assistance, I could only watch the curious and abhorrent spectacle, till a common spading fork was found with which the fire was put out by throwing earth upon it. The flesh was burned from the right shoulder, exposing the joint from the abdomen, allowing the intestines to protrude, and more or less from both legs. The leg bones were partially calcined. The clothing unburned consisted of parts of a calico dress, cotton vest, woollen skirt, and thick, red, woollen undergarment. The subject of the accident was a woman, forty-nine years of age, about five feet five inches in

height, and weighing not far from one hundred and forty pounds; of active habits and nervous temperament. A wife and mother, she was strictly a temperate person, accustomed through life to hard work, one who, in addition to her household duties, went washing and cleaning, besides doing a good share of the work in a large garden. On the fatal afternoon she had — as the place showed — been clearing a lot of stumps and roots, and had set fire to a pile of roots, from which it had communicated to her clothing, or it had spread into the woodland and had set fire to the clothing during her endeavors to stop it. The body lay about two rods from the burning pile. As proof that the flesh burned of itself, and nothing but the clothing set it afire, it may be stated that the accident occurred after a rain; that the fire merely skimmed over the surface of the ground, not burning through the leaves; that there was nothing but charred leaves under the body; that her straw hat which lay several feet distant was simply scorched; that the wooden handle of the spade was only blackened. The above case is interesting in several particulars. It is the first recorded case in which a human body has been found burning (that is, supporting combustion) by the medical attendant. It differs from nearly all of the recorded cases, in that it occurred in a person in middle life, not very fat, and not addicted to the use of alcohol. It is interesting in a medico-legal sense. It proves that under certain conditions — conditions that exist in the body itself — the human body will burn. We have abundant proof in the many recorded cases of so-called spontaneous combustion (seventy-three are chronicled in medical literature) that the body has been more or less completely destroyed by fire, under circumstances that show that it will support combustion, and this has given rise to the belief in the spontaneous origin of the fire."

— A gentleman in New York has recently tested the result of preserving a turkey in a refrigerator for ten years, says the *Boston Medical and Surgical Journal*. This time having elapsed, the fowl was removed from the refrigerator, and after being properly cooked was eaten by a party of gentlemen. While putrefactive changes seem to have been entirely absent it was found that the meat was practically tasteless.

— The annual general meeting of the Royal Meteorological Society was held on Jan. 27. Owing to the absence of the president, Mr. Baldwin Latham, through an attack of influenza, his address on "Evaporation and Condensation" was read by the secretary. The question of evaporation is of as great importance as the study of the precipitation of water on the face of the earth, as the available water supplies of the country entirely depend upon the differences between these two sets of observations. The earth receives moisture by means of rain, dew, hoar-frost, and by direct condensation. It loses its moisture very rapidly by evaporation. Although evaporation mainly depends upon the difference between the tensional force of vapor due to the temperature of the evaporating surface and the tensional force of the vapor already in the atmosphere, yet it is largely influenced by the movement of the air and by its dryness, or the difference between the dew-point and the actual air temperature. Evaporation goes on at night so long as the water surface is warmer than the dew-point. With sea-water the evaporation is about 4½ per cent less than with rain-water, while with water saturated with common salt the evaporation is 15 per cent less than with rain-water. In his experiments Mr. Latham used an evaporating gauge made of copper, one foot in diameter, and containing one foot in depth of water, which was floated by means of a hollow copper ring placed six inches distant from the body of the evaporator and attached to it by four radial arms. This form of evaporator was found extremely convenient in carrying on all evaporation experiments; it was floated in a tank four feet in diameter, containing thirty inches depth of water. During the period of thirteen years, from January, 1879, to December, 1891, this evaporator has never once been out of order or been interfered with in the slightest degree by frost. Experiments were made with some 5-inch evaporators as to the effect of color on the amount of evaporation, one being painted white, another black, and the results given by these gauges were compared with a copper gauge exposed under similar conditions. This comparison was the means of showing that the greatest errors in evaporating gauges arise from the capillarity of the water rising on the sides of the gauge and thus inordinately increasing the amount of evaporation. Consequently a small gauge having a larger amount, in proportion, of side area than a larger gauge, gives a very much greater amount of evaporation. The results from the floating evaporator, one foot in diameter, show that the average amount of water evaporated annually during 1879–91 was 19.948 inches. It was found, however, that, as a rule, during the period from October to March, there were certain occasions when condensation was measured. The amount of these condensations in thirteen years averaged .808 of an inch per annum The 5-inch evaporating gauge, freely exposed to atmospheric influences, gave during the same period (1879–91) an average annual depth of evaporation equal to 38.185 inches. The average annual evaporation during the three years 1879–81 from the 5-inch copper gauge standing in water was 27.90 inches, from one painted black, 22.97 inches, and from another painted white, 21.74 inches, whilst a gauge of the same dimensions, freely exposed in the atmosphere, gave in the same period 36.96 inches, and the 1-foot floating evaporator, 19.40 inches. The 5-inch copper gauge gave a larger amount of evaporation than the gauge painted black. Mr. Latham next described some percolation experiments which were carried out by Mr. C. Greaves at Old Ford, by Messrs. Dickinson and Evans at Hemel Hempstead, and by Sir J. B. Lawes and Dr. Gilbert at Rothamsted. He then detailed the results of his own experiments, and also the gaugings of the underground waters in the drainage areas of the rivers Wandle and Graveney. He further stated that in the course of his observations on the flow of underground water he had observed that at certain particular seasons of the year it was possible to indicate the direction and volume of the flow of underground streams, even when they were at a considerable depth, owing to the formation of peculiar lines of fog. Dr. C. Theodore Williams was elected president for the ensuing year.

— The *British Medical Journal*, in commenting on the death of a boy who died from drinking hot tea without milk, says that the tea had been left in the oven for some time, so that it had become a strong decoction of tannin. In being drunk without milk, the tannin was not brought into a relatively harmless albuminous tannate. It is on account of this method of making tea that it is so injurious to digestion. Neither the Chinese nor the Japanese, who know how to make tea, use milk with it; but with them the hot water is poured on and off the leaves at table, and it is drunk as soon as it becomes a pale straw color. No people in the world drink so much tea as the Japanese, yet in Japan it is never injurious to the digestion, as by their method of preparation the tannin is not extracted from the leaves.

— There will shortly be opened, probably early in March, in the Museum of Archæology of the University of Pennsylvania, a loan collection of objects used in religious ceremonies, including charms and inplements used in divination. The basis of the exhibition is the collection of oriental idols of the Board of Foreign Missions of the Presbyterian Church in the United States, comprising objects sent home by foreign missionaries through a period of sixty years. They include a series of Indian brass and marble idols, and a representative collection of Chinese deities and ancestral tablets. There are also a number of African idols from the well-known missionary station on the Gaboon River. This collection is supplemented by numerous loans from private collections and objects from different sections of the museum. A catalogue is in course of preparation which will contain sketches of the great religions of the world by Mrs. Cornelius Stevenson, Dr. Daniel G. Brinton, Dr. Morris Jastrow, and others. Ancient Egypt, India, Burma, China, Thibet, Japan, Aboriginal America, Polynesia, and Equatorial Africa will be represented by appropriate specimens, which are now being arranged and catalogued.

— At the opening session of the seventy-first meeting of the American Institute of Mining Engineers at the Johns Hopkins University, Baltimore, Md., on Tuesday evening, Feb. 16, Mr. George F. Kunz read a paper on the mining of gems and minerals in the Ural Mountains, illustrating his remarks with lantern slides made by himself on his trip last summer.

— The following experiment is reported in bulletin No. 15 of the Georgia experiment station: The object of this experiment was to determine the effect of applying varying quantities of each of the three elements — nitrogen, phosphoric acid, and potash. The section selected comprised one acre of very poor, gravelly soil, underlaid by a yellow pebbly clay, inclining to pipe clay. The original growth was scrubby post oak, red and yellow oak, and the soil is probably the poorest on the farm. It was in corn in 1890, fertilized at the rate per acre of 160 pounds of super-phosphate, 170 pounds of cotton seed meal, and 80 pounds of muriate of potash. The yield was 18 bushels of corn. The land was well broken, April 8, with a one-horse turn-plow, and harrowed smooth. April 14 it was laid off into fifty-two rows, running east and west, and four feet wide, using a long scooter, followed by a shovel. The section was then divided in the middle, across the rows, and grouped into plots of three rows each, extending half across the acre, from the west to the middle line, and from the middle line to the east side. The plots were numbered from 1 to 17, commencing on the north side of the west half and extending to the south side; then from 18 to 34, continuing from the south side of the east half to the north side. The normal or standard formula was: 156 pounds super-phosphate, 19.4 pounds of muriate of potash, and 32.4 pounds of nitrate of soda. This formula was applied to plots 1, 10, 18, and 27. On the next succeeding plots, 2, 11, 19, and 28, the potash was doubled, the other ingredients remaining the same. In the next series, plots 3, 12, 20 and 29, the nitrogen was doubled, the others remaining normal. In the fourth series, plots 4, 13, 21, and 30, both the potash and the nitrogen were doubled, phosphoric acid remaining normal. In the fifth series the phosphoric acid and potash were doubled, nitrogen remaining normal; and so on through to the eighth series. Plots 9 and 26, abutting each other, contained four rows each, and were not fertilized. By this arrangement of the plots inequalities in the character and productiveness of the different portions of the acre were approximately adjusted or corrected. In the table following the results are given, the yield in the case of the unfertilized plots being the average of two plots, and in every other case being that of four plots.

Series.	Fertilizers Per Acre.			Cost Per Acre.	Yield Per Acre.
	Super-phosphate.	Muriate of Potash.	Nitrate of Soda.		
1	156	19 4	32.4	$2.36	7 62
2	156	38.8	32.4	2.77	7.94
3	156	19.4	64.8	3.06	8.34
4	156	38.8	64.8	3 48	8.84
5	312	19.4	32 4	3.56	8.12
6	312	38.8	32.4	4.00	7.98
7	312	19 4	64 8	4.29	8.95
8	312	38.8	64.8	4 71	8 46
9	—	—	None.	—	5.00

— Dust, like the poor, we have always with us, nor has Hygeia with her newest brooms yet succeeded in banishing it. Yet there is abundant evidence to show that a dusty street contains more lurking potentialities of mischief than a jungle peopled with the hungriest wild beasts. To the researches of Miquel and others can now be added, says the *British Medical Journal*, the results of an elaborate investigation by Dr. Luigi Manfredi of the composition of the dust of the streets of Naples. The number of microbes of all kinds found in it amounted on the average to 761,521,000 per gramme. Remarkable differences in the proportion of micro-organisms were, however, observed in the dust from different quarters of the city. Thus, in the streets least exposed to contamination, that is to say, where there was the least traffic and where the hygienic conditions were most satisfactory, the average number of microbes in the dust was only 10,000,000 per gramme. On the other hand, in the busiest thoroughfares, the average rose to 1,000,000,000, and in some of the dirtiest streets to the enormous figure of 5,000,000,000 per gramme. In this "endless ocean" of infinitesimal life, there was a large number of pathogenic organisms, and the unhealthiness of the street or quarter was directly proportional to the number of microbes in the dust. Dr. Manfredi carefully tested the infective power of the dust, and obtained positive results in 73 per cent of his experiments. Of forty two cases in which he communicated disease to guinea-pigs by inoculating them with Neapolitan dust, he found the microbe of pus in eight, the bacillus of malignant œdema in four, the bacillus of tetanus in two, the bacillus of tuberculosis in three, not to mention several other microscopic *ferœ naturæ* possessing the power of inducing fatal septicæmia in the unfortunate guinea-pigs on which they were tried. The moral pointed by these discouraging facts is that our Ædiles should take the Dutch housewife for their example, and wage relentless war against dust and dirt of every kind.

— Prosessor William Guy Peck of Columbia College died suddenly in Greenwich, Conn., on Feb. 7, aged 72 years. He published, in 1859, "The Elements of Mechanics," in 1860, an edition of Ganot's "Physics," and was joint editor with Charles Davies of the "Mathematical Dictionary and Cyclopedia of the Mathematical Sciences." He wrote several other text-books in mathematics.

— The Institute of Jamaica has begun the issue of special publications. The first, the "Rainfall Atlas of Jamaica," contains thirteen colored maps showing the average rainfall in each month and during the year, with explanatory text. The maps are based upon observations made at 153 stations from about the year 1870 to the end of the year 1889. The available stations are irregularly distributed, being for the most part sugar estates and cattle-pens, and in consequence of this irregularity the island has been divided into four rainfall divisions. The north-eastern division has the largest rainfall, then comes the west central, next the northern, and lastly the southern. The annual distribution of the rainfall varies from 30 to 35 inches in a few places to over 100 inches in the north-eastern division. The greatest fall is in October, and the least in February. The driest stations are on the north-eastern and south-eastern shores. The maps show the distribution and average amount of rainfall very clearly by different tints, and cannot fail to be of both scientific and practical utility. The work has been prepared, according to *Nature*, by Maxwell Hall, the government meteorologist.

— The Equatorial current of the Pacific Ocean, striking against the Philippines and the islands lying to the south of that group, divides into two branches (*The Scottish Geographical Magazine*, February, 1892), one of which turns southwards to the coast of Australia, while the other, under the name of Kuro Shiwo, or Black Stream, flows past the Liu-Kiu Islands and the coast of Japan. Coming from the warmer equatorial regions, its waters have a higher temperature than that of the sea through which it passes, and hence its limits may be determined by observations of temperature. Its breadth and velocity are greatly modified both by the monsoons of the Chinese Sea and by the storms of the Pacific. In fair weather the Kuro Shiwo flows in an almost straight line from the Van Diemen Straits to Rock Island, touching Oshima on its way. In winter it often lies considerably to the south of this limit, but the line from Oshima to Rock Island may be taken as its northern boundary. Its course is marked by sea-weed and drift-wood, and also by the dark color to which it owes its name. From Rock Island it runs past Nosima Saki into the Northern Pacific. On the northern edge of this stream no current is found as a rule, though occasionally a current in the opposite direction has been noticed. Between the zone where no marine currents are found and the coast of Japan tidal currents occur. The breadth of the zone between the Kuro Shiwo and the coast increases during violent northerly winds, and diminishes when southerly and easterly winds prevail. When the latter blow steadily and with great strength, the current sets more or less directly onto the coast, causing high tides, and it is then necessary for ships to keep a sharp lookout, lest they should be driven ashore. The zone of tidal currents extends for a distance of five to six nautical miles from the coast, and their velocity varies in

general inversely as the breadth of this zone. At Oshima the tidal current is sometimes imperceptible, either because it is overpowered by the Kuro Shiwo, or because at that time it flows through the strait between Oshima and the main island.

— The New York Industrial Building, erected during the past year, is nearly ready for use. The furniture dealers will be the first to occupy the building, and other trades have bespoken it so that there will be a continuous exhibition or fairs of varying kinds. The building is in a most fortunate situation, occupying the block bounded on the east by Lexington Avenue, on the west by Depew Place, on the north by Forty-fourth Street, and on the south by Forty-third Street, within a short block of the freight depot of the Grand Central Railroad, and within reach of all the street cars connecting with the ferries by which New York is approached from New Jersey, etc.

— The influence of steam on magnets is the subject of an interesting note in the *Schweizerische Bauzeitung*, in which reference is made to the researches of Strouhal and Barus. These have shown that, with long continued heating in steam, magnets lose from 28 to 67 per cent of their power. If, after this, the magnets are remagnetized, and again exposed to the action of steam, only a very slight loss of magnetic power is found to take place. The experiments which have been made would seem to warrant the conclusion, also, that after such treatment a magnet is less liable to deterioration from mechanical vibration as well as heat. In one of the experiments a short magnet was boiled in water for four hours. It was then magnetized and held in an atmosphere of steam for two hours more, after which its magnetic moment was measured. It was then subjected to fifty blows from a piece of wood, both transversely and longitudinally. Again measuring, its magnetic moment showed a loss of $\frac{1}{100}$, and, on repeating the hammering with the wooden bar, the loss was $\frac{1}{100}$ of the original moment. In view of this, repeated steaming and magnetizing is recommended as a good means of securing permanent magnetism in pieces of hard steel.

— The Orang-Ulu are a people living in the southern part of Sumatra, who were visited by M. J. Claine during the summer of 1890 (*Asiatic Quarterly Review*, October, 1891). In May he arrived at Palembang, formerly the capital of the sultans of Palembang and now the seat of a Dutch resident. This town, containing a population of 60,000, composed of Malays, Arabs, Chinese, and a few Europeans, is situated on the Kuraa Sunsang, a branch of the Musi. Leaving Palembang in August, M. Claine ascended the Musi and its affluent, the Lemattang (Lamatang), to Muri-Enim (Muara Inim), about 186 miles from Palembang. Two days later the land journey was commenced, and, after a few hours' march, the country of the Orang-Ulu was entered by a bridge guarded by a group of natives. At Lahat the curious peak of Bukih Segello (Cerillo?) was photographed, and at Bandar, the last fortified post of the Dutch Government, a halt of two days was made. The country is mountainous and wooded, with here and there fine plains. The head-waters of the Lemattang run through profound gorges, and aborescent ferns afford a welcome shade from the burning rays of the sun. Soon after leaving Bandar M. Claine came in sight of the rich plateau of Passumah and the superb outlines of the Dempo, strongly marked against the sky, and came to a halt at Pager Alam. The Ulu are very similar to the Malays in outward appearance and costume, but, never having adopted Mohammedanism, they differ in their habits. Each village is governed by a *Creo*, or chief, who wears, as a sign of authority, a pair of gold-woven pantaloons, provided by the Dutch Government. His power is very limited, all his acts being controlled by the elders. The chief occupations of the men are smoking and cock fighting, while the women do all the hard work. They grow rice and cocoa-nut trees. The houses, like those in other parts of Sumatra and Java, are built on piles, and entered by means of a notched beam. The husband, on his marriage, is bound to enter the service of the wife's family. Marriage is celebrated with the following curious ceremony: An immense balance, adorned with leaves, is placed before the house of the bride, in one of its wooden scales the parents deposit fruit, rice, fuel, cocoa-nuts, and a small kid, and in the other the bridegroom is bound to lay before sunset the gifts he makes to his intended. As soon as the scale dips in his favor, the girl leaves the house and approaches him, and the ceremony is concluded by a feast and dance. On the 11th of September M. Claine set out with a Dutch officer to ascend the Dempor Passing by the village of Gunong Agun, through a region abounding in tigers, they reached the summit on the second day, and then, crossing a long and narrow plateau, ascended the Merapi volcano, visited seven years before by Mr. H. O. Forbes. The barometer marked 9,000 feet at the summit. From Pager Alam M. Claine made a tedious journey across the Passumah plateau to Padang-Bornay and Talang-Padang, crossing the Upper Musi several times by bamboo bridges. At Tebbing-Teggi (Tingi) he took passage on a coffee *prauw*, and descended to Palembang. The current is so rapid that it takes forty-five days to ascend the river, whereas three-fourths of the descent is accomplished in three days, and the remainder in four days and four nights.

— It has been proposed through the pages of the *British Journal of Photography* that upon the advent of the twenty-first birthday, in 1892, of the gelatino-bromide dry plate process, in photography, a substantial and fitting testimonial should be offered to Dr. R. L. Maddox, the inventor, now a veteran invalid, who has derived no pecuniary advantage from his valuable discovery, which has so largely advanced the progress of photography in all its branches, and in every country. For this purpose a committee has been formed in London, in order to carry out the scheme in the United Kingdom of Great Britain, consisting of the following gentlemen: Mr. James Glaisher, F.R.S., president of the Photographic Society of Great Britain, chairman; Captain W. de W. Abney, C.B., F.R.S., R.E., Messrs. A. H. Harman, F. York, and Sir H. Trueman Wood, assisted by others, as the executive, with the aid of Dr. A. Clifford Mercer, F.R.M.S., Syracuse, N.Y. For the furtherance of this project internationally, a foreign committee has been formed in Southampton, of the following gentlemen: James Lemon, Esq., Mayor of Southampton; Col. Sir Charles W. Wilson, K.C.B., F.R.S., R.E., director of the Ordnance Survey, Southampton; Major-General I. Innis-Gibbs, Captain Robert Evans, R.N. Subscriptions can be forwarded to the Southampton Branch of the National and Provincial Bank of England, by check or bank draft, crossed "Maddox Fund," or by post-office order; but, if preferred, they can be addressed direct to the secretary, Charles J. Sharp, solicitor, 71 French Street, Southampton, and will be acknowledged by him.

— The outlook for the recently discovered coal mines in the Argentine Republic is so favorable, according to *Engineering*, that the railway companies of that country have declined to renew their contracts with the British mines for fuel. Hitherto all the coal burned on the Argentine railroads has been imported, but it is believed that the newly-discovered mines will furnish a supply entirely sufficient for domestic consumption.

— Mail advices from the Argentine Republic bring information of the discovery of a vast bed of silver in the bottom of the bay of San Blas, Argentine Republic. The silver appears in the black metallic sand which covers the bottom of the bay. This sand is full of silver pellets, and divers have brought up a sufficient quantity to justify the belief, as stated by the Buenos Ayres *Standard*, that "the silver deposit in the bottom of the bay is greater than in the famous Bonanza mines of California."

— About four years ago there was inaugurated in Berlin a series of popular lectures on astronomy, illustrated with stereopticon views. This series has proved so successful that it has continued till the present time, and within ten days a similar course has been opened in New York. The lectures are given at the Carnegie Music Hall three times a week, and are entitled "A Trip to the Moon." The views shown are excellent and must certainly impress on those seeing them many an important fact in astronomy. The matter given by the lecturer varies somewhat as occasion may require.

— William Draper Lewis, Ph.D., is the author of a pamphlet recently published by the American Academy of Political and Social Science. The title of the essay is "The Political Organization of a Modern Municipality."

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ARSENICAL POISONING FROM DOMESTIC FABRICS.

PHYSICIANS long ago associated a certain class of symptoms with the presence of arsenic in the wall papers of the rooms inhabited by their patients. Of course, so long as the question was in this condition there was abundant room for mistake, and all that had been observed might be explained by some chance coincidence. It now appears that whenever the class of symptoms referred to are well marked there is arsenic present in the urine. It further has been shown in a number of cases that when the suspected wall paper was removed the arsenic disappeared from the urine of the patient, and the symptoms disappeared as well. The number of cases is large in which these points have been made: a certain class of symptoms, arsenic in the wall paper, arsenic in the urine of patients, wall paper removed, arsenic disappears from the urine, symptoms disappear in proportion.

Of course this is not absolute proof that the arsenic came from the wall paper, but, after a large number of cases of the same sort, the evidence amounts to moral proof, and it is rare in medicine to obtain evidence that is more conclusive.

How the arsenic gets from the wall paper to the patient is another question; but, although it would be satisfactory to establish this point, the proof of the *modus operandi* is not essential so far as the legal aspects of the case are concerned. Without this last proof it is easy to throw dust in the eyes of those not versed in such inquiries, but protective legislation has been taken again and again in cases where the risk is far less than here.

"The question how the injurious effects are produced by arsenical colors in our domestic fabrics is a moot point, some thinking it arises from arsenical dust, others holding to the gaseous theory."[1]

[1] Lecture on our Domestic Poisons, by Henry Carr, London, Health Exhibition Literature of 1884, Vol. IX., p. 189.

A New York chemist testified in a hearing on the subject in Boston, "I found that a botanist named Selmi, in experimenting on mould, found it produced a little hydrogen, and he invented the suggestion that the mould on the back of wall paper might produce a little hydrogen, which might unite with the arsenic on the front of the paper, and produce arseniuretted hydrogen, which might account for the popular idea that arsenical wall paper was dangerous."

This "botanist named Selmi," who may have the advantage of a knowledge of that science also, is an Italian chemist of first-class reputation, who has been publishing his work for at least eighteen years since 1874, and has devoted himself lately more especially to physiological chemistry. He is mentioned in Henry Watts's "Dictionary of Chemistry," Third Supplement, p. 122 (1879), by this reference, "On the detection of Arsenic in Toxicological Investigations, see Selmi (Gazz. Chim. Ital., II. 544)." An interesting paper has lately been issued by the Italian Ministry of the Interior from the scientific laboratories of the Bureau of Health, under the direction of Professors A. Monari and A. Di Vestea, prepared by one of Selmi's countrymen, Dr. B. Gosio, assistant in these laboratories, the following translation of which I am sure will interest your readers and assist in the solution of this problem. GEORGE S. HALE.

Action of Microphytes on Solid Compounds of Arsenic: A Recapitulation, by Dr. B. Gosio.[1]

It is well known that, under certain conditions, poisonous products may be developed from wall papers and tapestries colored with arsenical colors (Scheele's green, Schweinfurth's green), and experience has repeatedly demonstrated the serious evils that may arise from their use.

But as to the internal mechanism by which the said coloring-matters become hurtful, many doubts remained, and on certain points perfect obscurity. The idea advanced by Selmi met with favor, viz., that poisonous gases may in such cases be produced by the vital processes of microphytes; but in view of the small range of his experiments (some of which gave results adverse to his theory although tried on a large scale) the preference is given, on the whole, to the theory of William Forster. He says that wall-hangings and tapestries containing arsenical colors are poisonous by reason of the solid particles that are mechanically set free from them and penetrate the organism when inhaled in the form of fine dust. The same conclusion was reached by Giglioli of Naples after eight months of experiment on mould-cultures in earths (both solid and broken up in water), mixed with arsenious anhydride; and he explained his ill success by saying that probably arsenic is not compatible with the life of those germs that would be capable of developing hydrogen, and, therefore, the reducing mechanism was wanting.

On the other hand, the partisans of the parasite theory, while they draw from their observations only general criteria, have not been able, thus far, to point out what microorganisms are peculiarly suited to bring about the modifications of substance to which they refer; nor have they determined whether all the compounds of arsenic, or, if not all, which of them are most susceptible of these modifications. Thus, Bischoff relates that it was noticed that from a mixture of flour and common white arsenic (which had been used to poison a horse for purposes of revenge) a gas was developed which had the smell of garlic and the characteristics of arseniuretted hydrogen. But he neither states how it was found

[1] This study was communicated in advance to the last Congress of Hygiene, held in London, where the preparations were also exhibited.

possible to verify this phenomenon, nor could this fact serve to establish our proposition; for in his case the substance in question was arsenious acid, while the colors used in dyeing are salts of this acid, generally with a cupric base (Scheele's and Schweinfurth's greens), or sulphids of arsenic (realgar, orpiment). And it is obvious that this circumstance is not irrelevant; for arsenic or arsenious acid may be compatible with the life of certain germs while arsenite of copper may be incompatible, and, indeed, would at first sight appear to be so, if we consider the well-known antiseptic action of the salts of this metal.

Hence, in order to prove that tapestries which contain arsenical colors can become poisonous by reason of the transformation of the coloring-matter itself into volatile poisons as a result of the biological activity of the micro-organisms that vegetate in contact with it, it is necessary to prove that these micro organisms can exist with and do transform precisely those colors which are used in tapestries.

My experiments bring a contribution to this interesting question of hygiene and toxicology. The results obtained allow us to determine not merely whether from solid compounds of arsenic and from which of them (arsenious acid, arsenic acid, arsenites, arseniates) it is possible, through the action of microphytes, to develop arseniuretted hydrogen gas or volatile arseno-organic products, but also to determine what species are pre-eminently suited to produce this transformation. In the first place I prepared some potato pulps containing from 0.05 to 0.1 of arsenious anhydride to 1,000 of pulp. These, distributed in several broad Petri capsules, were kept for some days uncovered in a cellar. Soon the growth of moulds and of the common bacteria of the air was very abundant, and at the end of one week a strong smell of garlic began to be perceived, showing that gaseous arsenical emanations were taking place. The cultures were then placed in a large damp chamber, from which, by means of an automatic pump, a continuous current of air was drawn, and this was made to bubble up during about two weeks through a solution of nitrate of silver. A strong reduction of this salt, together with the formation, in Marsh's apparatus, of arsenical rings and spots obtained from the liquid after the elimination of the silver, were the indisputable proofs that the cultures had developed a reducing arsenical gas.

While this was a positive indication of great value in reaching a conclusion, other arsenical pulps in which also germs of many species had been developed gave no evidence of having undergone a similar decomposition. This disparity of results, if on the one hand it justifies the discordant conclusions reached by the various investigators, must, on the other hand, necessarily be accounted for by the generic diversity of the germs developed in the two cultures, since all the other conditions of temperature, humidity, atmosphere, nutrition, etc., had remained unchanged. And here began the work of separating the germs and the series of experiments on pure cultures, of which I will treat in detail in my larger work. Of the germs thus isolated some belong to the moulds, others to the schizomycetes; among the former I note penicillium glaucum, aspergillum glaucum, and, above all, as greatly preponderating in the mother culture, mucor mucedo. I would also have endeavored to ascertain exactly the species of other moulds and of the other saprophytes, if I had found them capable of bringing about the important transformations to which I refer, which was not the case.

Nevertheless, each of the germs obtained in pure culture and others also which are most commonly kept in the laboratories (B. radiciforme, B. prodigiosum, B. subtile, yellow sarcina, etc.) were cultivated separately in sterilized potato pulp rendered arsenical by 0.05 grams per 1,000 of arsenic acid. The cultures were kept at the temperature of the surrounding air (20°–27° C.), and in diffused light. After one month of observation I was able to ascertain that the production of arsenical gas (indicated by the characteristic garlic smell) had taken place only in the cultures of mucor mucedo and (in a far less degree) in that of aspergillum glaucum. It was not perceived in any of the other cultures.

In view of these facts, special importance attaches to mucor mucedo, a mould very widely diffused in our atmosphere and capable of reducing remarkable quantities of arsenic acid, as I have been able to make sure by strict chemical researches on the abundant cultures carried on in presence of arsenic anhydride and of alkaline arseniates.

In another series of experiments, intending to follow out the practical direction that I had adopted, I inquired whether this activity of the mucor could be extended to those preparations of arsenic which the art of dyeing utilizes in the coloring of papers and hangings in general. To this end the cultures were carried on in the presence of Scheele's green, Schweinfurth's green, realgar and orpiment.

Without here dilating on the course of each separate experiment and on the method of chemical investigation pursued (a thing which I will do in my forthcoming publication) I will sum up my matter in the following corollaries: —

1. Mucor mucedo tolerates remarkable quantities of arsenic not only without injury, but with advantage to its nutrition, for it grows more vigorously.

2. Many solid compounds of arsenic are, through the biological activity of the fungus that vegetates in contact with them, transformed into gaseous combinations, of which arseniuretted hydrogen is certainly one.

3. This transformation is brought about more or less rapidly, but is constant and lasting in the case of all the oxygen compounds of arsenic, including arsenite of copper, which is the basis of the green arsenical colors used in dyeing. It does not appear to take place in the case of the sulphids of arsenic (realgar, orpiment) although the presence of these in the cultures is not at all detrimental.

4. In given conditions of humidity, temperature and light, arsenical gases may be given off from hangings colored with Scheele's and Schweinfurth's greens, through the vegetation of the mucor (I cannot say yet whether of all the mucorini): hence the danger to those who live in such an atmosphere.

This statement of mine does not, of course, exclude the possibility that poisoning may be caused through inhaling the fine dust, as William Forster thinks. But it is evident that this could only happen as an exception, inasmuch as one essential condition of the production of the fine dust is a certain degree of dryness of the walls to which the papers adhere, whereas we have seen that the poisonous character of arsenical hangings is generally favored by a certain degree of humidity and can be suspected from a more or less intense smell of garlic in atmospheres which answer to the above-mentioned conditions.

I cannot yet say whether the product of the action of mucor mucedo on the oxygen compounds of arsenic is entirely arseniuretted hydrogen. I have reason to think that it is not. By the action of alkalies I have, in fact, constantly succeeded in setting free a volative substance smelling strongly of garlic from the silver solutions employed to oxi-

dize the assumed AsH_3 developed by the cultures. The gas so obtained, when burned by oxide of copper, furnishes an abundance of CO_2; but it is not possible, thus far, to reach any positive conclusions on this point, nor even to exclude the suspicion that the formation of the CO_2 may depend on the admixture of some other hydrocarbon gas. This point will be made clearer by the special studies that I have undertaken together with Dr. Gorini, for which I am making use of a large culture material.

September, 1891.

A PROBLEM IN PHYSICS.

IN *Science* for Nov. 28, 1890, there was a short note on the experiment conducted by Joule, in which air compressed in one cylinder was allowed to expand into an exhausted cylinder. It was shown that the only work done by the compressed air was that of imparting a velocity to its own particles, i.e., it did not expand against a resistance, and hence the chilling produced was slight. This experiment has not received the attention it deserves, and, moreover, it seems to have been entirely misinterpreted. It has been suggested that, while at the first instant on opening communication between the two vessels, there is an expansion into a vacuum and no work done, yet at the very next instant there is air in the previously exhausted cylinder, and there is work done in compressing that. This is a serious fallacy, and lies at the bottom of the misinterpretation. It is very certain that no work against a resistance is done at any moment during the expansion This experiment is so far-reaching in its application, and is so extremely important, that I desire to discuss it a little farther, and I sincerely trust that some one in a suitably-equipped laboratory may be induced to try a few simple experiments in this line.

Tyndall has shown that mere rarefaction is not a source of cold, though this is somewhat of a popular fallacy. Let us take a cylinder with a piston fitted air-tight and moving without friction. Let us consider that there is no loss of heat from the interior nor accession from the outside. Suppose the piston is raised suddenly from bottom to top. A perfect vacuum will be formed; but, as no work has been done below the piston, there will be no cooling effect; all the work and consequent heating would be at the engine, which may communicate with the cylinder, though a hundred feet away. Now, suppose a very thin film of air .001 of an inch thick were at the bottom of the cylinder. When the vacuum was formed this thin film would impart a velocity to its particles in order that they might follow the piston, but this air certainly would not expand against a resistance, and hence the chilling would be exceedingly slight. Suppose the piston should be at a point half-way from top to bottom; when it was raised the air beneath would impart a certain velocity to its particles in following the piston, but here again there would be no expansion against a resistance, and hence the chilling would be slight.

Let us change the conditions slightly. Instead of having the air at atmospheric pressure beneath the piston, as in the last case, let it be at double that pressure. On lifting the piston as before we have taken off the pressure and the air beneath imparts a certain velocity to its particles in following the piston. At the first instant that the piston starts there may be a very slight expansion against a resistance, but that would be momentary. The bulk of the cooling would, as before, be due to the fact that a velocity is imparted to the particles beneath the piston, and, in this case, this velocity would be given to a greater number of particles than before. The cooling would be slightly greater, also, but it would not be due to the loss of heat consequent upon the work of expanding against a resistance.

In order to compute the cooling in such cases as these, a formula has been used which will be found in the *American Meteorological Journal* for November, 1890, p. 339, as follows:

$$\frac{T}{T'} = \left(\frac{p}{p'}\right)^{.291}$$

In this T and T' are the absolute temperatures corresponding to p and p'. It seems to me, however, that this formula is not applicable in this case; for it gives a greater cooling, the less the work that is done. Suppose $\frac{p}{p'} = \frac{3}{4}$, the cooling by the formula would be 38°; if $\frac{p}{p'} = \frac{1}{3}$ the cooling would be 134°; and if $\frac{p}{p'} = 0$, or the expansion was in a vacuum, the cooling would be 490°. Now, by the principles already enunciated, if the expansion took place in a vacuum there would be no expansion against a resistance, and hence there would be no work done except in imparting a certain velocity to the particles. If the formula fails in the last case, it must also fail in all the others. It seems to me that the formula is only intended to be used in cases where there is an expansion against a resistance, and not in the cases here given.

A question has come up recently which may be partly answered by this discussion. It is this: What will be the cooling due to the expansion of gas in a balloon if it should ascend very suddenly to several thousand feet above the earth? Suppose the balloon were instantly put into a perfect vacuum, and the envelope had no resistance; there would be no expansion whatever against a resistance, as we have just seen, and the only work performed would be that of imparting a certain velocity to the particles of gas. As a result the gas would be slightly chilled, but vastly less than if it had expanded against a resistance. Now, if the balloon had been suddenly placed at a point where the pressure was ten inches, or one-third that at the earth, the same principles would apply; the only work done would be in imparting a certain velocity to the particles of gas, and in consequence there would be only a slight chilling.

I should be very glad if some physicist would kindly solve the following problems.

1. Given an exhausted cylinder of certain dimensions, how much would the air be heated if allowed to enter without noise, and until the pressure was the same as that outside?

2. What would be the cooling of a perfect gas in a balloon one-third full, if the pressure on the outside were suddenly reduced from thirty inches to ten inches, the temperature of the outside air remaining constant, the envelope of the balloon being without weight and infinitely flexible?

H. A. HAZEN.

THOMAS WHITTAKER announces a volume by Frederick Saunders (of the Astor Library), entitled "The Story of the Discovery of the New World by Columbus," the same being an abridgment from the latest authorities. It will be an illustrated quarto.

PROFESSOR GEIKIE ON THE GLACIAL PERIOD.

ON Nov. 12 the Edinburgh Geological Society held its anniversary meeting, at which Professor Geikie delivered his presidential address, the subject being, "Supposed Causes of the Glacial Period." The lecturer began by remarking that, although the subject of his address had frequently been canvassed, the last word had not yet been said. The question of the cause or causes of the Ice Age was indeed a hard one, and he was not going to advance any novel speculation or hypothesis on the subject. His object was rather to examine certain views, which, after having been abandoned as untenable, had again been put forward to account for the phenomena of the glacial period. Before attempting to criticise these views it was obviously necessary to ascertain, in the first place, what conclusions had been arrived at with regard to the climatic conditions of glacial or Pleistocene and post-glacial times. We must first have an adequate conception of those conditions before we could estimate the value of any theory of their origin. The climatic conditions of the Pleistocene were then considered. It was shown that at the climax of the so-called glacial period the line of perennial snow in Europe was depressed for not less than 3,500 feet on an average. To bring about such a depression the mean annual temperature must have been lowered 10° or thereabout.

Full consideration of all the glacial phenomena led to the following conclusions: (1) That the cold of the glacial period was a general phenomenon due to some widely acting cause — a cause sufficient to influence contemporaneously the climate of Europe and North America. (2) That glaciation in our continent increased in intensity from east to west, and from south to north. (3) That where now we have the greatest rainfall, in glacial times the greatest snowfall took place. (4) That in the extreme south of Europe, and in North Africa and South-western Asia, increased rain-precipitation accompanied lowering of temperature — from which it might be inferred that precipitation in glacial times was greater, generally, than it is now.

The remarkable climatic changes of the glacial or Pleistocene period were next considered. It had been proved that the period was interrupted certainly once — perhaps, as many geologists maintained, at least twice — by what were known as inter-glacial conditions. The evidence of this was treated in considerable detail, and the character of the inter-glacial climate was described as being markedly temperate and genial. There could be no doubt whatever that the Pleistocene period was characterized by great oscillations of climate — extremely cold and very genial conditions alternating. The evidence of the post glacial beds showed likewise that these had been accumulated under similar, but much less marked, alternations of cold and temperate climates. Lastly, attention was directed to the fact that both in Pleistocene and post-glacial times changes in the relative level of land and sea had taken place.

Any suggested explanation which did not fully account for these various climatic and geographical conditions could not be satisfactory. The view which had met with considerable acceptance, especially by American geologists, was that which attributed the phenomena of glacial times to great movements of the earth's crust. Professor Geikie then proceeded to examine that "earth-movement hypothesis" in detail. He pointed out that in the first place there was not the least evidence of great continental elevations in the northern hemisphere, such as the hypothesis postulated. Next, he showed that even if the desiderated earth-movements were admitted, they would not account for the phenomena. Each of the several applications of this earth-movement hypothesis was criticised in succession, with the result that they were all found inadequate. Neither great elevation of the northern lands alone, nor such elevation accompanied by submergence of the Isthmus of Panama and the deflection of the Gulf Stream, would account for the peculiar conditions of the Ice Age. These changes, no doubt, would profoundly affect the maritime regions of North America and Europe, but they would not reproduce the conditions that obtained at the climax of the Ice Age. Another objection to the earth-movement hypothesis was this, that it did not account for inter-glacial conditions. The advocates of that hypothesis imagined that those conditions would supervene when the highly-elevated northern regions were depressed to their present level, and when the Isthmus of Panama reappeared. But these were precisely the conditions that obtained at the present time, and yet in spite of them the climate was neither so equable nor so genial as that which obtained in inter-glacial times and during the mild stage of the succeeding post-glacial period. The earth-movement hypothesis must be rejected, not only because it was highly improbable that such wonderfully rhythmic elevations and depressions of high northern lands and of the Isthmus of Panama could have taken place, but chiefly because it did not explain the conditions of the glacial period, while it practically ignored those of inter-glacial times.

Professor Geikie next considered the proofs of former submergence which are so abundantly met with in temperate and northern latitudes, and discussed the various views which have been advanced to account for the facts. He concluded his address by considering an objection which had been urged against the physical theory of the glacial period as advocated by the late James Croll. This objection was based on certain estimates of the rate of erosion of river-valleys, the accumulation of alluvial deposits, and so forth, from which it was sought to show that only some 7,000 or 10,000 years had elapsed since the close of the glacial period. The consideration that, if this contention were true, it would bring the close of the Ice Age down to the dawn of civilization in Egypt was rather startling, to say the least. The fact was, however, that all such estimates, however carefully made, were unreliable. Dr. Croll's theory might some day be supplanted by one more satisfactory, but it would not be overturned by niggling and inconclusive measurements of that kind. That theory holds the field in giving the simplest and most consistent interpretation of the climatic vicissitudes of the Pleistocene and post-glacial periods, while it is the only one that throws any light on the very remarkable conditions that obtained during inter-glacial times.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

The Loup Rivers in Nebraska.

PERMIT me to submit through your columns to Professor Hicks the following questions and comments on his acceptable account of the Loup and Platte Rivers in *Science* for Jan. 29 last.

The topographic maps of the region in question are too incomplete for one to learn much from them concerning the present condition of the river valleys; but from general descriptions of that part of the country and from the brief mention by Professor Hicks of the "channels excavated from fifty to two hundred feet

in soft tertiary marls" it may be inferred that the streams are little advanced in their present cycle of development. Professor Hicks postulates that at the beginning of the current cycle of river history, the several branches of the Loup River all pursued independent courses to the Platte. The origin of those early courses is not stated; whether they were consequent on the slanting surface of the tertiary marls, or whether they represented the finally adopted positions of old rivers of a previous cycle of growth.

Old rivers, revived by the uplift of the plains into a new cycle of growth are common enough in the western country, and perhaps the Platte and Loup may be of that kind; but, if so, it does not seem possible to explain the present course of the main Loup River as resulting from a recent capture of its several north-west branches. River captures occur during the early maturity of a river system. If the Platte and the Loup are revived from the old stage of a previous cycle, the captures should have taken place in the earlier part of that cycle; and when the river courses had thus become well adjusted, they would be maintained even after uplift and entrance into another cycle, unless distinctly new conditions were thereby introduced. The possibility of this will be considered in a later paragraph.

If the rivers are not now in a second cycle of development, but are in their first cycle, having first taken their course when their region rose from the waters in which its strata were deposited, and having since then done nothing more than cut their shallow trenches in the general unbroken surface of the country, then we must ask whether their initial courses must have been in the arrangement postulated by Professor Hicks, or whether they may not from the beginning have had courses essentially on their present lines of flow. This latter alternative appears to be indicated at the end of Professor Hicks's article, if I read it aright. Assuming that the last great tertiary lake not only submerged the area of the Loup River, but spread its lacustrine sediments over the surface so as to obliterate any channels of earlier date, then on the disappearance of the lake, the rivers would be newly developed on the faint slopes of its deposits. The Platte, bringing down silt in large amount, may have been at that time a constructive river, busied in building up a broad delta-like flood-plain, further and further out on the lacustrine deposits as they were revealed. If so, it would turn its lateral tributaries down-stream, and the existing arrangement would be produced without the aid of headwater erosion and capture. Hence, until the process of flood-plain deflection is excluded, it does not seem necessary to include the process of headwater erosion and capture.

But even if it be supposed that the courses of the rivers at the beginning of the present cycle were arranged as postulated by Professor Hicks, and that all of them from the Beaver to the South Loup entered directly into the Platte, it seems impossible to explain their present arrangement by the headwater erosion and piracy of the Loup. The conditions for so systematic a process do not occur in the region under consideration, as will appear from the following analysis.

In the first place, it is important to remember that it is not the river but the little trickling headwater streams on the slopes of the divides that do the capturing in cases of the kind here discussed. The capture of one river by another, or lateral abstraction, as described by Gilbert in his most original examination of this problem in his report on the Henry Mountains is a comparatively rare occurrence, and is not applicable here.

In the second place, capture by little headwaters is most common in regions of tilted rocks of varied hardness, and on the headwaters of "subsequent" streams; that is, streams whose headwater-growth is dependent on the opportunity given by the weathering of some especially weak stratum, along whose strike the stream extends. No such special opportunity has been offered to the Loup River in this region of horizontal beds.

In the third place, as one headwater stream grows, all other adjacent headwaters of the same kind grow at about the same pace. Hence, if the Loup River has so greatly extended itself by headwater erosion, all the other headwater streams should have grown also, and the country thereabouts would be much more dissected by channels than it now is.

Finally, the location of Prairie Creek seems to contradict the supposition that the branches of Loup River ever joined the Platte directly; for, if they had, then Prairie Creek must be, like the supposed extension of the Loup, an example of headwater erosion; and this is not to be thought of in a stream so systematically located between two parallel and larger rivers in a district of horizontal beds.

Taken all together, it does not seem necessary to give any especial emphasis to headwater erosion and capture in this river system. The natural result of excessive deposition along the Platte, as described by Professor Hicks, is alone sufficient to account for the present arrangement of the streams. The growth of the Platte flood-plain may have dammed back some of its tributaries, as certain branches of the Red River in Louisiana are dammed back and converted into shallow lakes; and the present main Loup River would then be developed by lateral overflow along the margin of the flood-plain; but this is quite another process from headwater erosion and capture.

These suggestions are only tentative; for not having seen the region and having no full account of its geological history or of its topography, I can only submit them for criticism.

W. M. DAVIS.

Harvard College, Feb. 10.

Origin of the Frigid Period in the Northern Hemisphere.

IN my letter, published in your issue of Oct. 16, I stated that the independent circulation of the southern ocean waters was the main cause of ice-sheets forming on the lands situated in the high latitudes of the southern hemisphere; and that such currents were caused by the strong westerly winds, which blew the surface waters of the southern ocean constantly around the globe, and thus prevented the tropical surface currents from largely entering its waters. Consequently, through this cause and the constant gathering of ice in the antarctic regions the temperature of the southern latitudes was slowly lowering; and that the growing coldness would continue until the southern ice-sheets filled the Cape Horn channel and prevented the further independent movement of the southern ocean waters. This being accomplished, the westerly winds would blow the surface waters of the sea away from the eastern side of the ice-formed isthmus and the southern lands of South America, and so cause a low sea-level, that would attract the surface waters of the tropical seas far into the southern latitudes, and thus in time furnish heat sufficient to melt the ice from the southern lands I also stated that an ice period could not be perfected in the northern hemisphere without the assistance of cold derived from a frigid period in the southern hemisphere. The independent circulation of the arctic waters is not complete, owing to land obstructions; but it is able to largely prevent the tropical Gulf Stream waters from entering the higher northern latitudes. The prevailing westerly winds blow the surface waters of the Atlantic away from the eastern shore of North America from Georgia to Labrador; consequently the low sea-level thus caused attracts the high-level tropical waters of the Gulf of Mexico through the Florida channel well into the northern latitudes; and during the same time the westerly winds which blow the surface waters of the Atlantic away from the American coast are also causing a high sea-level on the seas abreast north-western Europe, which creates a return current through the Arctic Ocean, passing through the several straits leading into Baffins Bay, and also down the eastern coast of Greenland. Thus the ocean waters of the high northern latitudes maintain a partly independent circulation, which serves to crowd the Gulf Stream away from the higher latitudes, and thus lower the temperature of the arctic regions. Through this exclusion of tropical waters, glaciers have formed on Greenland and other arctic shores; and these glaciers are probably slowly increasing, as every iceberg launched from the frigid lands and floated to the Gulf Stream lowers somewhat the temperature of the north Atlantic, and so causes conditions more favorable for larger accumulations of ice. Still it is probable that a northern ice period could not be perfected by this process alone should the tropical and southern oceans maintain their present temperature. But with the assistance of a frigid period in the

southern hemisphere to cool the ocean waters and still further lower the temperature of the Gulf Stream, and also the tropical currents of the oceans, including the great Japanese current, the ice period of both hemispheres would be brought about during the same era. For it is well known to those who have studied the subject that the Gulf Stream derives a large portion of its heat from the south Atlantic; which would not be the case should the waters of the southern hemisphere be chilled by ice. For it appears that all of the south Atlantic islands during frigid times were burdened with glaciers. Even the island of St. Helena, situated in the tropical zone, has the appearance of having been heavily iced during some remote period. Its steep ravines, which deepen as they approach the sea, recall to the southern voyager the ice-worn islands of the higher latitudes. Thus when the temperate regions of both hemispheres were heavily iced the temperature of the tropical seas must have been comparatively low, especially on the eastern sides of the oceans which are swept by the polar currents. Moreover, the sea was much salter than now, on account of a large portion of its waters being absorbed by glaciers. Furthermore, whenever the arctic channels are filled with glaciers the independent circulation of the arctic waters must cease; consequently the Gulf Stream, meeting with less opposing polar currents on its sweep northward, would thus be able to gain a much higher latitude than now. Although its waters at first would be colder than they are to-day; still their superior saltness would add to their ability for dissolving ice wherever they were able to flow. But it appears that the Gulf Stream and other tropical currents of the northern oceans would not be able to subdue the cold accumulated in northern ice-sheets without the assistance of a comparatively warm ocean in the southern hemisphere. The southern seas being so much superior and so widely connected with the northern, the tropical currents of the latter seas would require the assistance of the southern oceans to subdue the cold of a northern ice period, in the same degree that it required their co-operation to bring about the frigid period. The arctic straits, which now facilitate the independent circulation of cold Arctic waters, would, when filled with glaciers, be slow to thaw out, even with the increasing warmth of the arctic regions, on account of being situated to the windward of the warm gulf currents. Therefore, the glaciers that filled their deep channels would be the last great body of ice to melt in the northern regions; and for this reason it is probable that there are fragments of the old ice of the last frigid period still unmelted and now form a portion of the lower shores of the arctic straits. This conclusion is in harmony with reports from Point Barrow which inform us that a stratum of pure ice is found beneath the scanty soil. The low temperature of the waters of the tropical oceans during the perfection of a frigid period must have been very destructive to oceanic life; while such as survived probably found refuge in nearly landlocked equatorial seas, where the waters were largely excluded from the colder ocean, and also freshened by such rivers as emptied into them. Meanwhile, the low temperature of the ocean must have chilled the atmosphere over the land to such a degree as to have caused the destruction of many species of animals.

C. A. M. TABER.

Lake Como, Florida, Feb. 5.

Electricity in Agriculture.

THE abstract under the above title in *Science* for Jan. 15, 1892, which I have only just found time to read, proves very interesting to me, and I do not wish in any way to have it inferred that I disbelieve in the influence of electricity, at least indirectly, upon the growth of plants; but it does not seem out of place to call attention to the fact that the comparative rarity of mildew on plants grown above electricity-bearing copper wires in moist soil may be due to the action of the copper salts formed in killing the mildew rather than to electrical action.

The roots of the lettuce in the experiment mentioned at "Garden A" (*Science*, p. 36) are stated to have "grown about the wires, as if there they found the greatest amount of nourishment," etc. This would also be the result from the roots seeking the environment best suited for growth, if the mildew could not thrive about the wires on account of the trace of copper salts which the soil contained.

The use of sprays containing copper salts, in the form of Bordeaux mixture or similar compounds, as a preventive of mildew of grape-vines and other plants is well known, and the control plot, "Garden B," should have been provided with copper wires, exactly as was "Garden A," to make the results of the experiment conclusive. As I have not seen the original article in the Bulletin of the Hatch Experiment Station, from which the abstract in *Science* was taken, it may be the fact that this action of the copper salts upon mildew has been discussed there.

GEORGE DIMMOCK.

Canobie Lake, N.H., Feb. 15.

AMONG THE PUBLISHERS.

E. & F. N. SPON & Co. announce "Roll Turning for Sections in Steel and Iron," by Adam Spencer. The subject of roll-turning is treated from a purely practical point, and for practical men. The drawings are the result of experience, and their value consists in the fact that they are working drawings, that is, drawings of rolls which have passed through the ordeal of actual work. The arrangement of the work is as follows: First, drawing of modern blooming for steel slabs, followed by a pair of billet rolls, then various sections showing the related grooves in cogging, roughing, and finishing rolls, with the position and character of collars required. "A Text-Book of the Science of Brewing," by Edward Ralph Moritz and George Harris Morris. The following extract from the introduction will show its character: "The object of this work is to provide in a convenient and accessible form such knowledge of the processes of brewing and of the materials employed in that industry as is at our disposal; and — so far as we are able — to connect such knowledge with the practice of brewing. We therefore intend it as a text-book in which may be found the results of scientific research together with the practical conclusions which we consider justly deducible from them. We do not pretend that a perusal of our work will enable a novice to brew beer; neither will a study of it convert a purely practical man into a chemist. It is meant, however, to lead the brewer to a better understanding of what we may term the physiology and pathology of brewing, and, by so doing, put at his disposal a means for more efficient control over his operations." "Manual of Instruction in Hard Soldering," by Harvey Rowell. "The Mechanical and Other Properties of Iron and Steel in Connection with Their Chemical Composition," by A. Vosmaer, engineer. The author has gathered together the widely scattered information on this important subject, and gives in brief outline the actual knowledge of the intimate connection that exists between the properties of steel and iron and their chemical composition. The elements — carbon, manganese, silicon, phosphorus, sulphur, copper, chromium, titanium, tungsten, aluminium, nickel, cobalt, arsenic, antimony, zinc, lead, tin, silver, molybdenum, vanadium, potassium, sodium, barium, strontium, calcium, and magnesium — have been considered separately and in the following manner: First, as to the metallurgical behavior of the elements in question; next, to deal with their influence on pig iron, cast iron, wrought iron, and steel; lastly, the special uses made of them, and their occurrence in manufactured objects. The gases, intermolecular, reaction, and mixed, have been carefully considered, and analyses given of foundry, bessemer, basic, and forge pig-irons, spiegel-irons, ferromanganese, ferrosilicons, ferrochromes, ferrotungsten, ferroaluminium, cast-irons, weld irons. Steel — railway material, structural steel, ordnance material, miscellaneous. With a diagram of silicon in cast iron, and of disappearance of carbon. Also a new edition of "A Practical Treatise upon Warming Buildings by Hot Water."

— Morris Phillips of the *Home Journal* goes abroad every summer for recreation and business. He has kept up that habit for nearly twenty years, besides travelling widely over this country, and as a result of his experiences he has just compiled a note-book of practical hints for tourists entitled "Abroad and at Home," in which he gives incidents of his travels, as well as a

complete statistical and detailed account of the cost of trips in Europe and America. It promises to be a valuable guide-book for Americans.

— Henry Holt & Co. will add immediately to Sneath's series of modern Philosophers, volumes extracted from Reid by Dr. Sneath of Yale University; from Spinoza, by Professor Fullerton of the University of Pennsylvania; from Kant by Professor Watson of Queen's College, Canada; and from Descartes, by Professor Torrey of the University of Vermont. They contemplate adding, in the near future, volumes from Berkeley, Hume, and Hegel.

— "The Basis of the Demand for the Public Regulation of Industries" is the title of a monograph by the Hon. W. D. Dabney, which has recently been published by the American Academy of Political and Social Science. There have been numbers of plans suggested to remedy these evils, the most notable of which is, probably, socialism. Mr. Dabney thinks that this plan will not be adopted, but that government regulation of private business will be tried as remedy for the existing evils of private monopolies.

— The Department of Astronomy of the Brooklyn Institute of Arts and Sciences has just issued a "Hand-book of Astronomy for 1892." The publication is in a new field, and is one that will command general interest and constant use by a very large number of people who have considerable general knowledge of astronomy, and who desire to couple with information gained by reading a practical knowledge from experience and observation. The new publication is designed to aid in the observation of the planets and the constellations every hour when they are visible during the year 1892. The hand book will not only prove interesting to the "amateur" astronomer, but also to those who are working with instruments in observatories. It contains calendars of the eclipses of the sun and moon, of the periods of the inferior planets as morning and evening stars, and of the periods of the greatest brilliancy and elongation of the planets, a selection of the most important occultations of stars, calendars of the positions of the sun, moon, and planets for each day of each month, brief accounts of the opposition of Mars, of the evidence of Venus' rotation, tables showing the motions and positions of Jupiter's satellites, the names and positions of colored stars and double stars, tables of the variable stars of long periods and of short periods, accounts of the zodiacal light and the principal meteoric showers of the year, together with a great deal of valuable information concerning the satellites, the distances of planets and stars, the lengths of the years of the planets and the weights and dimensions of the members of the solar system. A calendar for the seasons and the church calendar are convenient additions. Copies of the hand-book may be purchased by members of the institute, or by others interested in astronomy, at twenty cents per copy, including postage.

CALENDAR OF SOCIETIES.

Philosophical Society, Washington.

Feb. 18.—Gardiner G. Hubbard, The History of the Education of the Deaf; A. W. Greely, Some Peculiarities in the Rainfall of Texas.

Society of Natural History, Boston.

Feb. 17.—George L. Goodale, Illustrations of Vegetation in Ceylon.

Publications received at Editor's Office.

BOWSER, EDWARD A. Elements of Plane and Solid Geometry. 2d ed. Boston, D. C. Heath & Co. 12°. 393 p. $1.85.

BROCKWAY, FRED J. Essentials of Medical Physics. Phila., W. B. Saunders. 12°. 330 p. $1 net.

HARVARD COLLEGE. Annual Reports of the President and Treasurer, 1890-91. Cambridge, The University. 8°, paper. 294 p.

HEMPEL, WALTHER. Methods of Gas Analysis. Trans. from the German by L. M. Dennis. New York, Macmillan & Co. 12°. 401 p. $1.90.

LEFAVEL, CARRICA. Delsartean Physical Culture. New York, Fowler & Wells Co. 12°, paper. 108 p.

MCKILLOP, DUGALD. Shorthand and Typewriting. New York, Fowler & Wells Co. 12°, paper. 128 p.

MUNRO, J. Heroes of the Telegraph. London, Religious Tract Society. 12°, 288 p. $1.40.

MUSEUM OF FINE ARTS. Catalogue of the Print Department. Boston, The Museum. 12°, paper. 96 p.

SCOTT, W. The Lady of the Lake. Ed. by William J. Rolfe. Boston, Houghton, Mifflin & Co. 16°, paper. 273 p. 80 cents.

SCRIBNER'S MAGAZINE. Index to Vols. I-X. New York, Charles Scribner's Sons. 8°. 89 p.

THURSTON, ROBERT H. A Manual of the Steam Engine. Part II. Design, Construction and Operation. New York, John Wiley & Sons. 8°. 957 p.

WHITE, CHARLES E. Number Lessons. Boston, D. C. Heath & Co. 12°. 201 p. 45 cents.

Business Department.

Intending investors and others interested in real estate matters in the rapidly developing State of Washington are invited to give a careful reading of the advertisement of the Washington Fire Clay Company on first page of this number. Mr. C. Cooper Clark, Vice-President, will show photographs and blue prints of the property advertised. The writer is personally acquainted with all the officers and many of the stockholders of this company and can vouch for the entire reliability and truthfulness of any statements they may make.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

A PROFESSORSHIP in Chemistry is wanted by one who has had five years' experience in that capacity. Would prefer to give instruction by lectures and experiments rather than by text-book methods. Would like a position in a college or university where there is a good student's laboratory. Special points of strength claimed are: (1) Thorough control of a class and good order during lectures and recitations. (2) Accuracy in experimenting with chemicals and skill in the manipulation of chemical apparatus. The permission of several distinguished educators has been given to refer to them if required. Would not care to accept a position paying less than $1,500. Address B. E., care of *Science*, 874 Broadway, New York.

ADDRESS WANTED.—Will some one please send the address of the Secretary of the American Philological Society. Also that of Herbert Spencer. "ADDISON," Room 84, 164 Madison St., Chicago, Ill.

ADDRESSES of Old Book Dealers wanted.—Wishing to obtain a number of old books out of print, I very much desire the addresses or catalogues of rare second-hand book dealers. If there is a directory or list of such dealers I should like to obtain possession of one. W. A. BLAKELY, Chicago, Ill.

WANTED.—Books on the Magic Lantern. Will exchange, "How the Farm Pays," by Cosier and Henderson; "Culture of Farm Crops," by Stewart; "American Agriculturist," 1890 and 1891. I. SLEE ATKINSON, 43 Wallace St., Orange, N. J.

WANTED.—(1) A white man versed in wood and iron working, able to work from specifications and plans, suited for an instructor of boys; his business to have charge of shops of school, outline and direct the work for foremen and students; salary to be $1,000 per annum (nine months). (2) A man (black preferred) to teach the colored, iron working and forging, subordinate to the preceding; salary, $720. (3) A man (white) competent to take classes in engineering (assistant's position), but with the ability to perform any of the work required in any of the ordinary engineering courses of our universities; salary from $1,000 to $1,500. A. H. BEALS, Milledgeville, Ga.

BOOKS: How to Exchange them for others. Send a postal to the SCIENCE exchange column (insertion free), stating briefly what you want to exchange. SCIENCE, 874 Broadway, New York.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

To exchange; Experiment Station bulletins and reports for bulletins and reports not in my file. I will send list of what I have for exchange. P. H. ROLFS, Lake City, Florida.

Finished specimens of all colors of Vermont marble for fine fossils or crystals. Will be given only for valuable specimens because of the cost of polishing. GEO. W. PERRY, State Geologist, Rutland, Vt.

For exchange.—Three copies of "American State Papers Bearing on Sunday Legislation," 1891, $2.50, new and unused, for "The Sabbath," by Harmon Kingsbury, 1840; "The Sabbath," by A. A. Phelps, 1842; "History of the Institution of the Sabbath Day, Its Uses and Abuses," by W. L. Fisher, 1859; "Humorous Phases of the Law," by Irving Browne; or other works amounting to value of books exchanged, on the question of governmental legislation in reference to religion, personal liberty, etc. If preferred, I will sell "American State Papers," and buy other books on the subject. WILLIAM ADDISON BLAKELY, Chicago, Ill.

Wanted, in exchange for the following works, any standard works on Surgery and on Diseases of Children: Wilson's "American Ornithology," 3 vols.; Coues' "Birds of the Northwest" and "Birds of the Colorado Valley," 2 vols.; Minot's "Land and Game Birds of New England;" Samuels' "Our Northern and Eastern Birds;" all the Reports on the Birds of the Pacific R. R. Survey, bound in 2 vols., morocco; and a complete set of the Reports of the Arkansas Geological Survey. Please give editions and dates in corresponding. R. ELLSWORTH CALL, High School, Des Moines, Iowa.

Wanted to buy or exchange a copy of Holbrook's North American Herpetology, by John Edwards. 5 vols. Philadelphia, 1842. G. BAUR, Clark University, Worcester, Mass.

For sale or exchange, LeConte, "Geology;" Quain, "Anatomy," 2 vols.; Foster, "Physiology," Eng. edition; Shepard, Appleton, Elliott, and Stern, "Chemistry;" Jordan, "Manual of Vertebrates;" "International Scientists' Directory;" Vol. I. *Journal of Morphology;* Balfour, "Embryology," 2 vols.; Leidy, "Rhizopods;" *Science*, 18 vols., unbound. C. T. McCLINTOCK, Lexington, Ky.

To exchange Wright's "Ice Age in North America" and Le Conte's "Elements of Geology" (Copyright 1882) for "Darwinism," by A. R. Wallace, "Origin of Species," by Darwin, "Descent of Man," by Darwin, "Man's Place in Nature," Huxley, "Mental Evolution in Animals," by Romanes, "Pre-Adamites," by Winchell. No books wanted except latest editions, and books in good condition. C. S. Brown, Jr., Vanderbilt University, Nashville, Tenn.

For Sale or Exchange for books a complete private chemical laboratory outfit. Includes large Becker balance (200g to 1-10mg.), platinum dishes and crucibles, agate motors, glass-blowing apparatus, etc. For sale in part or whole. Also complete file of *Silliman's Journal*, 1862-1885 (62-71 bound); Smithsonian Reports, 1854-1883; U. S. Coast Survey, 1854-1869. Full particulars to enquirers. F. GARDINER, JR., Pomfret, Conn.

—The *Chautauquan* for March presents the following among other articles: Growth and Distribution of Population in the United States, by General Francis A. Walker; Physical Culture, II., by J. M. Buckley; National Agencies for Scientific Research, V., by Major J. W. Powell; Ocean Perils, by Felix L. Oswald, M.D; The Ownership of Literary Property, by George Haven Putnam; Lyceum Attractions of To-day, by W. H. Stenger; The National Library and its Librarian, by Fannie C. W. Barbour; Words to the Deaf, by Katherine Armstrong; What Women Owe to Inventions, by Margaret N. Wishard.

—John Wiley & Sons have in preparation a work on timber and metallic structures entitled "Theory and Practice in the Designing of Modern Framed Structures." This book is written jointly by Professor J. B. Johnson, author of "Theory and Practice of Surveying," and professor of civil engineering in Washington University, St. Louis, by Mr. C. W. Bryan, designing engineer of the Edge Moor Bridge Works, Wilmington, Del., and by F. E. Turneaure, instructor in civil engineering in Washington University. It will describe in great detail the most modern and approved styles of structures and methods of analysis, giving only a historical review of obsolete forms of trusses and abandoned analytical methods. It will treat not only of bridges and roofs but also of trestles, viaducts, stand-pipes, elevated tanks, and steel skeletons for high buildings. It will be adapted to serve both as a text-book in the higher engineering schools and as a hand-book for the designing engineer.

—Houghton, Mifflin, & Co. have just ready "Mark Hopkins," illustrious as president of Williams College for thirty-six years, and as president of the American Board of Commissioners for Foreign Missions for thirty years, by Professor Franklin Carter, present president of Williams College; also a new work, by Dr. Josiah Royce, entitled "The Spirit of Modern Philosophy."

MA 10 1892

SCIENCE

A WEEKLY NEWSPAPER OF ALL T[illegible] ARTS AND SCIENCES.

PUBLISHED BY N. D. C. HODGES, 874 BRO[illegible]

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CONTENTS.

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SCIENCE

NEW YORK, MARCH 11, 1892.

THE SCIENTIFIC ALLIANCE.

THE Scientific Alliance of New York was organized in March, 1891. It consists at present in a union of six societies engaged in the promotion of scientific research. It is probable that this number will soon be increased to eight, and it is hoped that it may ultimately extend to at least ten. Membership in the Alliance is not confined to societies in New York City, but may include those in the neighborhood.

The societies now composing the Alliance,—naming them in the order of their foundation,—are as follows: 1. The New York Academy of Sciences, 2. The Torrey Botanical Club, 3. The New York Microscopical Society, 4. The Linnean Society of New York, 5. The New York Mineralogical Club, 6. The New York Mathematical Society.

The societies do not in any way sink their individuality or surrender any part of the management of their own affairs. Their union is merely in the way of co operation for the advancement of science and for mutual encouragement, carried out through a central representative body, known as the Council, having advisory powers only. The Council is made up of the president, *ex-officio*, and two other delegates from each society.

A monthly bulletin is issued under the authority of the Council, announcing the proposed proceedings of all the societies, and a copy of this bulletin is sent to every member. The bulletin contains an invitation to the members to attend the meetings of all the societies.

The Council issues an annual directory, containing the names and addresses of all the resident members of the societies, as well as general information as to the character and purposes of the several organizations. It is proposed to issue also a brief annual report of the work done by the societies as a whole. The first directory published by the Council (that for 1891) contained 499 names. That for 1892 will contain a considerably larger number, as the membership of the societies has increased materially during the past year.

The New York Academy of Sciences was chartered as The Lyceum of Natural History, April 20, 1818. It was reorganized under its present name Feb. 21, 1876. It has a total membership of about 550, of which nearly one-half are resident members and fellows. It holds weekly meetings, on Monday evenings, from October to June. One evening of each month is devoted to a popular lecture. There are special sections of mineralogy and astronomy. Its place of meeting is now at Columbia College. The Academy publishes both Annals and Transactions. The Lyceum of Natural History was the owner of a building and a valuable scientific collection, which were destroyed by fire. The Academy possesses a library of between 10,000 and 12,000 volumes, which is being continually augmented by periodicals and Proceedings of kindred societies received in exchange for its own publications. This is an exceedingly important collection of scientific works, containing sets of the Proceedings of foreign bodies not to be found in any other library in New York, and in some cases not elsewhere in this country. At present the books are deposited in the library-building of Columbia College, but they may be withdrawn at any time.

The Torrey Botanical Club was incorporated April 21, 1871. It has a total membership of nearly 300, of which about one-half are resident members. It holds meetings twice a month, at Columbia College, and field-meetings every Saturday from April to November. It publishes a Bulletin and Memoirs. It has an herbarium of nearly 20,000 specimens. Its botanical library is incorporated with that of Columbia College. It consists of periodicals and Proceedings of other scientific societies, obtained by the exchange of publications, which are, for the most part, duplicated in the library of the Academy of Sciences.

The New York Microscopical Society was incorporated in 1877. It has a total membership of about 100, of whom some 75 are active members. Its meetings are held twice a month, at the Mott Memorial Library, No. 64 Madison Avenue. It publishes a quarterly journal. Its library consists of about 2,000 volumes, and is deposited at its place of meeting. It has also a collection of about 5,000 microscopical specimens.

The Linnean Society of New York was organized March 7, 1878. It has a membership of 85, of which about half are resident members. Its meetings are held twice a month, at the American Museum of Natural History. It publishes Transactions and an Abstract of Proceedings. It has a library consisting of exchanges from publications.

The New York Mineralogical Club was organized in 1887. It has a memberihip of about 60. It holds monthly meetings at various places. It owns the Chamberlain collection of New York Island minerals, which is deposited temporarily, with other strictly local minerals, in the American Museum of Natural History.

The New York Mathematical Society was organized Nov. 24, 1888. It has a membership of over 200, including almost every mathematician of note in America, and some residing abroad. Its local membership is about 35. It publishes a monthly Bulletin.

It will be seen from the foregoing summary that all of the societies included in the Alliance occupy only temporary quarters, and that their libraries and collections are widely scattered. It will be observed, however, that the latter are of sufficient size and importance to make a very creditable appearance if they could all be gathered in a single suitable place. It is confidently believed that the total amount of original scientific work brought out by the meetings of these societies is as great as that accomplished in any other city in America. Under proper conditions, however, the societies might not only become more helpful to one another, but might confer a greater benefit upon the community at large, by carrying on lines of work which they are now compelled to neglect from want of room and facilities. For example, all attempts at exciting popular interest in scientific subjects is now confined to a course of seven or eight lectures during the year, carried on by but one of the societies, when, in fact, if the Alliance were placed in possession of the necessary building and appliances, there is no reason why it

might not exert the same educational influence in New York as is put forth by the Royal Institution of Great Britain in London, in which a course of as many as eighty lectures of more or less popular interest has been given in a single season.

The brief experience which the Scientific Alliance has already had has convinced the members that a still closer union of the societies is necessary to the most effective accomplishment of their purpose, and this feeling has taken the form of an earnest movement for obtaining a permanent building as a home for all the societies. A building committee was appointed in October last, and has held several meetings and done much towards developing plans for the accomplishment of the object mentioned.

In the main these plans embrace the idea of the erection of a building, in the central part of the city, large enough to afford each society rooms for its ordinary meetings, for its library and collections, as well as facilities for research, and also to contain a lecture-hall, capable of seating twelve hundred people, to be used by all the societies in their public work. It is part of the aim of the Council to obtain, ultimately, if not at once, in connection with the proposed building, a fund for its maintenance and for the endowment of original research and publication.

It is hoped and believed that at this time, when public spirit appears to be undergoing a revival in New York, and numerous worthy objects are receiving generous aid and establishment by men of wealth, the cause of science will not be overlooked or neglected. Music and other fine arts and various charities have recently received munificent assistance in the very direction in which the Alliance is looking for aid,—namely, the erection of buildings suited to their particular needs,—and it seems reasonable to think that the man, or men, will soon be found with sufficient appreciation of scientific research, for both its educational and its practical value, to place it in a position as solid and substantial as that now likely to be occupied by the fine arts and by organized benevolence.

ACTINISM.

On studying the nature of the action of the blue, or rather the violet, ray of the spectrum, it appears to me to be a misnomer to refer to it as chemical. The absorption of heat attends chemical decomposition, and on the other hand the disengagement of heat is the accompaniment of chemical combination. We read in Professor Wurtz's excellent treatise on "The Atomic Theory:" "It is heat which sets the atoms in motion; they have absorbed heat in separating from each other, since the rupture of the molecular equilibrium which marks the end of the state of combination has required the consumption of a certain quantity of heat. The heat thus absorbed has restored to the atoms the energy which they possessed before combination, and which represents affinity. This heat is lost again whenever the atoms, passing into the sphere of action of other atoms, fix the latter in some manner or are fixed by them so as to form new systems of equilibrium — that is, new molecules — in which henceforth their vibration and motion are preserved. This action is reciprocal." If with this we compare what takes place in the so-called chemical action of the violet ray, we find a great difference. The latter process is usually referred to as one of decomposition and not of combination, and, in fact, photography is based on the property possessed by light of decomposing chemical compounds by its reducing action.

It is true that this decomposition is supposed to be attended with certain chemical changes, as is the case also with the decomposition of amyl and other vapors in Dr. Tyndall's very interesting experiments in cloud making, although there appears to be some doubt as to the nature of the changes. Moreover, in the action of the violet ray on a mixture of chlorine and hydrogen gases the formation of hydrochloric acid would seem to be due to the operation of chemical affinity. Nevertheless, when we consider the analogy between this case and that of the formation of water by the passage of a current of electricity through a mixture of oxygen and hydrogen gases, a question may be raised as to whether the former is due to strictly chemical action. The phenomenon of electrolysis, in which the electric current decomposes a molecular compound, is, moreover, analogous to that of the decomposition of chemical compounds by the actinic action of the violet ray. The latter phenomenon answers to the decomposing action of heat, and the former to the combination of elements which attends chemical action; but they are not the same. This is evident from the fact that, while in the one case the combination precedes the discharge of heat on which decomposition depends, in the other case it follows decomposition.

Nevertheless, in all cases actinic action would seem to be attended with the aggregation of at least one element of the decomposed chemical compound. Thus, when on the exposure of chloride of silver to the action of light the chlorine is expelled, the silver is precipitated. The result depends on the instability of the equilibrium of chemical combination in the presence of certain light-rays, and it is thought that all substances are thus more or less affected by light. It is found that the red rays are chemically inactive, and of the others the absorbed rays are those which bring about the decomposition which is the basis of actinic action. The liquid nitrite of amyl allows the transmission of the yellow rays, and Dr. Tyndall states that the blue rays, as complementary to the yellow, are absorbed, and therefore that they produce the "chemical" effect. As a fact, however, the complementary of yellow is violet, and the greatest actinic action is in the violet ray, and it extends far beyond into the invisible rays. This in itself would seem to prove that actinism is not chemical action, as the intimate relation between this force and heat would lead us to expect the association of chemical action with rays towards the red end of the spectrum. The vibrations of heat are atomic and not molecular, and possibly this fact may have influenced Dr. Tyndall in his opinion that the absorption of the actinic rays occurs in the main within the molecule, and are not the act of the molecule as a whole. There is no reason, however, why the absorption should not be of the whole molecular mass; that is, of the body of molecules that make up the mass, just as the absorption of heat is that of the atoms which make up the molecule.

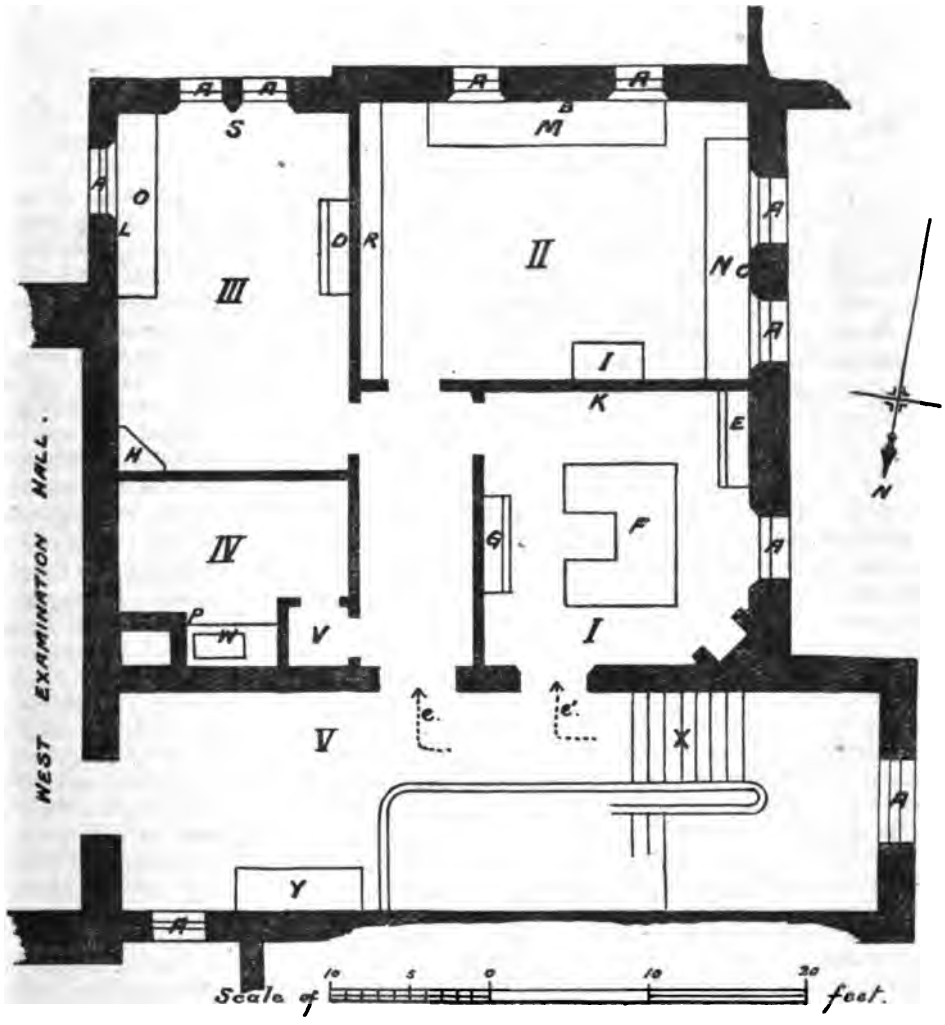
Here would seem to be the real explanation of the phenomena of actinism, which is a distinct power of light due to its activity as a molar energy, just as heat is an atomic energy. The combination which follows the decomposition effected by actinic action has a similar relation to chemical combination. The latter is atomic, whereas the former is molar, as it affects the mass, and this through its molecules and not through the atoms of which these are composed. From the fact that the electric light contains a large proportion of actinic rays, and that the electric spark in rarified air is diffused and of a violet color, it might be supposed that actinism is only a phase of electricity. That they are closely

related we may judge by what was said above, but there are reasons for believing them to differ from each other as they both differ from heat, although all alike are forms of energy. Actinic absorption, like coloric absorption, is attended with decomposition, but so far as the former is attended with or followed by an aggregation or combination of elements, as with chemical affinity, it is also a force, but molar rather than molecular or atomic. In distinguishing between these forms of matter, I adopt the principle laid down by Mr. Grant Allen, although not all the applications he makes of them, and I believe that in the recognition of the truth of those principles will be found the solution of many scientific problems.

C. STANILAND WAKE.

THE PSYCHOLOGICAL LABORATORY IN THE UNIVERSITY OF TORONTO.[1]

IN the spring of 1891 an appropriation of $1,100 was made for the equipment of a laboratory for experimental psychology at the instance of the writer. A suite of rooms, of which the accompanying cut gives the dimensions and arrangement, was set apart for the use of this department. The laboratory is located at the west end of the restored University College building on the first (not the ground) floor. It is isolated entirely from the general work of the building, being over the rooms of the physical department. The rooms have light exposure from three sides. The room which is used for students' demonstration and practical work (I. in the plan) is cut off from the research rooms, thus making interruptions to the latter from noise, etc., unlikely. For the same reason, the central hall is laid with cocoa matting. The work-tables of the research rooms (II. and III.) get light from the east, south, and west, a variety which is of great value, especially as the east exposure (Room III.) has reflected light from the walls of the main building (this is also partly the case with the light from the west windows, Rooms I. and II.). The rooms are artificially lighted by combination gas and electric chandeliers from the ceilings, and have besides movable incandescent lamps over the work-tables. The dark room is also furnished with incandescent lights. The floors throughout are carefully laid in hard wood. The



A, A; A, Windows.

I. Demonstrating-room and work-room for undergraduates. G. Work-table; E. Book-cases; K. Blackboard; F. Demonstration-table; e'. Students' entrance; e. Professor's entrance.

II. Research-room. M, N. Work-tables; B, C. Lockers, movable incandescent lights; I. Chart-case, movable tables; R. Instrument-cases.

III. Professor's Research-room. O. Work-table; D. Book-cases; H. Closet for tools, &c; L. Movable incandescent light, lockers; S. Writing-desk.

IV. Dark-room. W. Sink; V. Vestibule; P. Incandescent light.

V. Private hall. X. Stairs; e. Professor's entrance; Y. Instrument-cases.

[1] The accompanying plan is published at the suggestion of several psychologists who have borrowed and examined it; it is thought that the details may be of use to professors, boards, or trustees who are contemplating the providing of laboratories.

work-tables are braced diagonally from the walls by iron rods. The rooms are heated by steam radiators. The walls and ceilings are finished in dull white and the woodwork in dark walnut, colors being avoided in order to keep the physiological conditions of sight normal. Natural and colored light can be let into the dark room through the south wall. The central hall is lighted through glass panels in the doors.

The fittings of the laboratory have cost about $450 — a grant additional to the appropriation of $1,100 for instruments. This does not include, however, the arrangements for lighting, heating, and the special flooring. It is probable that the cost would be slightly more in the United States. Of the original amount appropriated, moreover, $300 is an annual allowance for the maintenance of the laboratory. The writer hopes, also, to have soon a paid assistant, who will be constantly at work in the rooms.

The laboratory will, it is hoped, serve two main purposes: First, it is used to illustrate the undergraduate courses in psychology in the university; and, second, it is designed to serve as a centre for advanced research in the new lines of experimental work. Being the only foundation of the kind in Canada,[1] it will represent what we are doing in this line in the Dominion. The Department of Education of Ontario undertakes with great liberality to publish the researches of students who do work of real merit, and to distribute them generously. Publications issued from other such centres everywhere will be received in return with much gratitude; and new ideas in matters of technique, arrangement, etc., especially detailed notices of new pieces of apparatus, reprints from the journals, and announcements of new discoveries, will be welcome. J. MARK BALDWIN.

NOTES AND NEWS.

AT a meeting of the Royal Geographical Society on Feb. 22, Mr. Theodore Bent read before a large audience a paper on his recent exploration among the Zimbabwe and other ruins. The paper, says *Nature*, was one of great interest. Mr. Bent said that, with his wife and Mr. Robert Swan, he went to Mashonaland primarily to examine the ruins of the Great Zimbabwe. These ruins, so named to distinguish them from the numerous minor Zimbabwes scattered over the country, were situated in south latitude 20° 16′ 30″, and east longitude 31° 10′ 10″, at an elevation of 3,300 feet above the sea-level, and formed the capital of a long series of such ruins stretching up the whole length of the west side of the Sabæ River. They covered a vast area of ground, and consisted of the large circular building on a gentle rise with a network of inferior buildings extending into the valley below, and the labyrinthine fortress on the hill, about 400 feet above, naturally protected by huge granite bowlders and a precipice running round a considerable portion of it. Mr. Bent gave a minute description of the ruins, drawing attention to evidence that their ancient inhabitants must have been given to the grosser forms of native worship. Perhaps the most interesting of their finds in one portion were those in connection with the manufacture of gold. Mr. Bent held that the ruins and the things in them were not in any way connected with any known African race; the objects of art and the special cult were foreign to the country altogether, where the only recognized form of religion was, and had been since the days when the early Portuguese explorers penetrated into it and El Masoudi wrote, that of ancestor worship. It was also obvious that the ruins formed a garrison for the protection of a gold-producing race in remote antiquity. So we must look around for such a race outside the limits of Africa, and it was in Arabia that we found the object of our search. All ancient authorities speak of Arabian gold in terms of extravagant praise. Little, if any, gold came from Arabia itself; and here in Africa gold was produced in large quantities, both from alluvial and from quartz, from the remotest ages. A cult practised in Arabia in early times was also practised here; hence there was little room for doubt that the builders and workers of the Great Zimbabwe came from the Arabian peninsula, He had no hesitation in assigning this enterprise to Arabian origin, and to a pre-Mahommedan period.

[1] The first in the British Dominion as far as my information goes.

— The United States Hydrographic Office makes a report of the magnetic storm of Feb. 13–14, 1892, as recorded by the self-registering magnetic instruments of the United States Naval Observatory, Washington, D.C. These records of this unusually severe magnetic storm are of especial interest as occurring at the same time as the fine displays of auroræ and the appearance of a large group of sun spots. The magnetic storm commenced suddenly at 12.40 A.M. (75th meridian time), Feb. 13, with a movement of the north end of the declination magnet to the westward and a rapid increase in the horizontal and decrease in the vertical components of the earth's magnetic force. The north end of the declination magnet remained to the westward of its normal position until 10.30 A.M, when it crossed to the eastward, all the time oscillating violently, and did not return to its normal position until 8 P.M. of the 13th, after which it kept oscillating on each side of its mean position until the end of the storm. It registered a change of direction of 1½°. The first increase in the horizontal force was followed by a rapid decrease, the force falling to much less than its usual strength, with rapid changes. Its change during the storm was 2½ per cent of its mean strength. The vertical force decreased so much that the sensitive balanced magnet used to record it was upset at 8 P.M. of the 13th, and its further record lost. The auroræ were seen at Washington at about 2 A.M. and 7.30 P.M. of the 13th, the latter time being marked by an unusually disturbed condition of the magnets.

— The usual monthly meeting of the Royal Meteorological Society was held on Wednesday evening, the 17th of February. A paper on "The Untenability of an Atmospheric Hypothesis of Epidemics" was read by the Hon. Rollo Russell. The author is of opinion that no kind of epidemic or plague is conveyed by the general atmosphere, but that all epidemics are caused by human conditions and communications capable of control. In this paper he investigates the manner of the propagation of influenza, and gives the dates of the outbreaks in 1890 at a large number of islands and other places in various parts of the world. Mr. Russell says that there is no definite or known atmospheric quality or movement on which the hypothesis of atmospheric conveyance can rest, and when closely approached it is found to be no more available than a phantom. Neither lower nor upper currents have ever taken a year to cross Europe from east to west, or adjusted their progress to the varying rate of human intercourse. Like other maladies of high infective capacity, influenza has spread most easily, other things being equal, in cold, calm weather, when ventilation in houses and railway cars is at a minimum, and when perhaps the breathing organs are most open to attack. But large and rapid communications seem to be of much more importance than mere climatic conditions. Across frozen and snow-covered countries and tropical regions it is conveyed at a speed corresponding, not with the movements of the atmosphere, but with the movements of population and merchandise. Its indifference to soil and air, apart from human habits depending on these, seems to eliminate all considerations of outside natural surroundings, and to leave only personal infectiveness, with all which this implies of subtle transmission, to account for its propagation. "The Origin of Influenza Epidemics" was the title of a paper by Mr. H. Harries. The author has made an investigation into the facts connected with the great eruption of Krakatoa in 1883, and the atmospheric phenomena which were the direct outcome of that catastrophe. He has come to the conclusion that the dust derived from the interior of the earth may be considered the principal factor concerned in the propagation of the recent influenza epidemics, and that, as this volcanic dust invaded the lower levels of the atmosphere, so a peculiar form of sickness assailed man and beast. A "Report on the Phenological Observations for 1891" was made by Mr. E. Hawley. This report differs in many respects

from the previous reports on the same subject. Among other changes, the number of plants, etc., selected for observation has been greatly reduced, while the number of observers has considerably increased. The winter of 1890–91 proved in England very destructive to the root crops, as well as to green vegetables and tender shrubs. Birds also suffered severely. In Scotland and Ireland, however, there was scarcely any severe weather until March. The flowering of wild plants was greatly retarded by cold in the spring, but during the summer the departures from the average were not so great. The harvest was late and its ingathering much interfered with by stormy weather.

— Recent experiments by Messrs. W. Thomson and F. Lewis on the action of metals on india-rubber, according to *Engineering*, show that that of copper is the most deleterious. Platinum, palladium, aluminium, and lead act only very slightly, while magnesium, zinc, cadmium, cobalt, nickel, iron, chromium, tin, arsenic, antimony, bismuth, silver and gold have no action whatever on this material. Of metallic salts, those of copper are very destructive, but nitrate of silver, manganese oxide, and several less common salts are equally so. The nitrates of iron, sodium, uranium, and ammonia have also a deleterious action, though less pronounced than in the case of the salts previously mentioned.

— At the anniversary of the British Geological Society, held on the 19th of February, the retiring president, Sir Archibald Geikie, gave the annual address, which was devoted to a continuation of the subject treated of by him last year. He now dealt, according to *Nature*, with the history of volcanic action in this country from the close of the Silurian period up to older Tertiary time. The remarkable volcanic outbursts that took place in the great lakes of the Lower Old Red Sandstone were first described. From different vents over central Scotland, piles of lava and tuff, much thicker than the height of Vesuvius, were accumulated, and their remains now form the most conspicuous hill-ranges of that district. It was shown how the subterranean activity gradually lessened and died out, with only a slight revival in the far north during the time of the Upper Old Red Sandstone, and how it broke out again with great vigor at the beginning of the Carboniferous period. Sir Archibald pointed out that the Carboniferous volcanoes belonged to two distinct types and two separate epochs of eruption. The earlier series produced extensive submarine lava-sheets, the remains of which now rise as broad terraced plateaux over parts of the lowlands of Scotland. The later series manifested itself chiefly in the formation of numerous cones of ashes, like the *puys* of Auvergne, which were dotted over the lagoons and shallow seas in central Scotland, Derbyshire, Devonshire, and the south-west of Ireland. After a long quiescence, volcanic action once more reappeared in the Permian period; and numerous small vents were opened in Fife and Ayrshire, and far to the south in Devonshire. With these eruptions the long record of Palæozoic volcanic activity closed. No trace has yet been discovered of any volcanic rocks intercalated among the Secondary formations of this country, so that the whole of the vast interval of the Mesozoic period was a prolonged time of quiescence at last when the soft clays and sands of the Lower Tertiary deposits of the south-east of England began to be laid down, a stupendous series of fissures was opened across the greater part of Scotland, the north of England, and the north of Ireland. Into these fissures lava rose, forming a notable system of parallel dykes. Along the great hollow from Antrim northwards between the outer Hebrides and the mainland of Scotland, the lava flowed out at the surface and formed the well-known basaltic plateaux of that region. The address concluded with a summary of the more important facts in British volcanic history bearing on the investigation of the nature of volcanic action. Among these Sir Archibald laid special stress on the evidence for volcanic periods, during each of which there was a gradual change of the internal magma from a basic to an acid condition, and he pointed out how this cycle had been repeated again and again even within the same limited area of eruption. In conclusion, he dwelt on the segregation of minerals in large eruptive masses, and indicated the importance of this fact in the investigation, not only of the constitution and changes of the volcanic magma, but also of the ancient gneisses where what appear to be original structures have not yet been effaced.

— Dr. L. Swift of Rochester, N.Y., discovered a bright comet on the morning of March 6. The object is in R.A. 18 h. 59 m., Dec. south 31° 20′. It is moving easterly.

— As bearing on the vital question of the exhaustion of the coal resources of Belgium *Engineering* states that, while the average depth of the French coal mines is 1,056 feet, the average depth in Hainaut is 1,773 feet; that in the Mons Basin there is a pit now being worked of 2,988 feet in depth, and another unworked pit in the same district of 3,801 feet; while in April last it was reported that in a Borinage pit, known as "Sainte Henriette des produits," at Flénu, a rich seam of coal had been discovered at the extraordinary depth of 4,120 feet. These figures tend to show that Belgium is rapidly exhausting the "cream of the coal resources" of the country — that is, coal found within 2,000 feet of the surface.

— A. Coppen Jones, writing from Davos Platz, Switzerland, to *Nature*, says: "In 1889 a French naval surgeon, M. Ledantec, published in the *Annales de l'Institut Pasteur* the result of some investigations he had made into the nature of the arrow poison of the natives of the New Hebrides. Wounds from these arrows give rise, as is well known, to tetanus, and M. Ledantec was able, by the subcutaneous injection of the scraped off poison, to kill guinea-pigs under typical tetanic symptoms. He learnt from a Kanaka that they are prepared by smearing the arrow-heads (which are made of human bone) first with tree gum and then with mud from a swamp, which mud he found to contain numbers of Nicolaier's tetanus bacillus. As far as I am aware, this has been recorded only of the natives of the New Hebrides and some of the neighboring groups (the arrow poison of Stanley's dwarfs is certainly *not* the same), and I was therefore much interested some days ago by coming accidentally upon an old record which seems to show that the natives of the Cape Verd coast were accustomed, more than three hundred years ago, to get rid of their enemies in a similar manner. In Hakluyt's "Voyager's Tales," published in 1589 (I refer to the little reprint edited in 1889 by Henry Morley), is the narrative of one Miles Phillips, in which occurs the following passage: 'Upon the 18th day of the same month (November, 1567) we came to an anchor upon the coast of Africa at Cape Verde, in twelve fathoms of water, and here our General landed certain of our men, to the number of 160 or thereabouts, seeking to take some negroes. And they, going up into the country for the space of six miles, were encountered with a great number of negroes, who with their envenomed arrows did hurt a great number of our men, so that they were enforced to retire to the ships, in which contest they recovered but a few negroes; and of these our men which were hurt with their envenomed arrows, there died to the number of seven or eight in a very strange manner, with their mouths shut, so that we were forced to put sticks and other things into their mouths to keep them open.' In the language of modern medicine, they succumbed to tetanus traumaticus. The voyagers left the coast soon after, and there is no further mention of the natives or of the wounded. There is, of course, no proof that the arrows were poisoned with mud or earth, but the probability is considerable. The chief interest lies in the age of the record, which forms in some manner a pendant to the researches of M. Bossano (*Comptes rendus*, 1888), which showed the tetanus bacillus to have a very wide distribution in space. It is a curious consideration that this and the other famous arrow poison, curare, both kill by their action on the voluntary muscles, the action of one being diametrically opposed to that of the other."

— The *Electrical Review*, New York, the first electrical weekly published in this country, issued a decennial number dated Feb. 20, 1892, in commemoration of its tenth birthday. The past decade of electrical progress is presented, and what may be expected in the future of this science is outlined. Articles specially contributed to this issue by leading electrical workers appear, with many portraits of interest.

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CURRENT NOTES ON ANTHROPOLOGY. — I.

[*Edited by D. G. Brinton, M.D., LL.D.*]

Evolution of the Human Skull.

DR. PAUL TOPINARD of Paris, whose studies in physical anthropology place him in the front ranks of that science, has summed up in a recent number of *L'Anthropologie* the results of several years' investigations concerning the transformation of the animal into the human skull. He demonstrates that this change is brought about by the gradual development of the brain, and the resulting mechanical pressure on the hard parts adjacent. The pressure exerted by the enlarging hemispheres on the occipital bone is in a direction backwards and downwards, so that what is its superior surface in ordinary mammals becomes the posterior in man, and its posterior face the inferior. The occipital foramen, instead of looking backwards, is in man turned downwards. The increase in size of the anterior lobes of the hemispheres brings about still greater changes in that portion of the cranium. The orbits are pressed from a lateral into a frontal position, the face, instead of being in front and oblique, becomes vertical, and below the frontal lobes; and numerous minor alterations in the anatomy of the parts are necessitated by these changes. It is easy to arrange a perfectly graduated series of skulls illustrating this development from the lowest mammals up to man. Next to him are the monkeys, below these the lemures, and then follow the inferior mammals. Everywhere the principle of harmonic accommodation of organ to function is strikingly shown. Although the general statement of this evolution has been frequently advanced, it has never before received so complete a demonstration.

Physical Types in the Natives of South America.

The effort has repeatedly been made to subdivide the native tribes of South America on purely physical characters. It was attempted more than fifty years ago by Alcide D'Orbigny, in his "L'Homme Americain;" but his plan has not proved satisfactory. The latest scheme is that of Dr. Deniker, who accompanied the French scientific expedition to Cape Horn. He measured some eighty odd Yahgans, a tribe who live on the southern shore of Tierra del Fuego. He found them of short stature, head large and mesocephalic, prominent superciliary ridges and malar bones, forehead narrow, low, and retreating, eyes small and horizontal, orbits medium, mouth large, lips thick, slight prognathism. On the strength of these measurements, Dr. Deniker has urged in various scientific publications that we find in the Yahgans a "race" quite different from the Patagonians and allied to the Botocudos, the Coroados, and the Aymaras, as well as to the ancient Lagoa Santa peoples. This grouping, allowing that it is anatomically accurate, serves to illustrate how useless is an ethnographic classification based on small anatomical points. The Aymaras, Botocudos and Yahgans are as far apart in language, culture and character as any tribes which could be selected in South America. Moreover, the Botucudos differ widely among themselves is physical aspects, as Dr. Paul Ehrenreich has abundantly shown. In fine, it is high time to dismiss the anatomical subdivisions of the American race, and rely on language as, after all, when prudently employed, our best guide.

Deniker's theories will probably attract the more attention by being brought into relation with the interesting recent discoveries by Florentino Ameghino in the eocene beds of Patagonia. This eminent geologist has described, in a late number of the *Revista Argentina de Historia Natural*, the remains of four species of monkeys from what he believes to be the lower eocene — which would place them far more remote than any found in Eurasia, the oldest there exhumed being from the middle miocene. Ameghino therefore claims Patagonia as the cradle af the first Primates and of the immediate precursors of Man. Nor does he hesitate in this connection to add that in his opinion the very oldest relics of man's activity have been found in the same district.

We must, however, temper this enthusiasm by some hesitancies. When Ameghino assigns these beds to the lower eocene, he does so entirely on palæontologic grounds. The more cautious geologists are getting to rely less and less on these, and to demand more and more stratigraphic testimony. This is alone convincing. The native fauna of Australia to-day is much older in type than that of Eurasia; and similar instances no doubt existed in all ages of the world's history. Moreover, the remains which Ameghino describes are strictly American in type. His *Anthropops perfectus*, although it had its teeth disposed in a semicircle, as in man, had nevertheless thirty-six teeth, as had all the American monkeys, both recent and fossil. His *Homunculus Patagonicus* was yet more Lemurian in type. The evidence is far from adequate, therefore, to substantiate the daring inductions which Ameghino draws from these finds.

The Question of the Celts.

The latest contribution to the vexed question of the ethnographic position of the Celts is from the pen of the veteran anthropologist of Bonn, Professor Schaaffhausen. It is published in the *Festschrift zum Fünfzigjährigen Jubiläum des Vereins von Alterthumsfreunden im Rheinlande.* It includes a careful review of the classical authorities on the Celts and Gauls; in which one is surprised to find a denial that the bands who overran Italy in 393 B.C. were Celtic. Surely the title of their chiefs, *brennus*, "king," is evidence enough that they spoke a Celtic dialect. The professor is also sadly out in attributing the North African blonds to immigration from Europe. The blond type is essentially

that of the Hamitic Berbers who have lived in the vales of the Atlas from the remotest times. In attributing the megalithic monuments of western Europe and northern Africa exclusively to Celtic and Germanic peoples, he proceeds beyond what archæologists have conceded. The difficult problem of the conflicting physical types among the Celtic nations — the one short in stature, brachycephalic, and brown, the other tall, dolichocephalic, and blond — he summarily solves by supposing either an intermixture with other types or a change in mode of life and climatic environment. The Celtic language he places, as do now all leading linguists, within the Aryan group and in that category most closely allied to the Italic stock.

The same topic is discussed very ably by the French anthropologist, Dr. R. Collignon, in one of the recent bulletins of the Société d'Anthropologie. After setting forth in strong lights the embarrassing nature of the evidence, he finally leans to Broca's opinion, that the small, brown, brachycephalic Celts are a mixed type; while the true and primitive type, which we may call the Kymric, was one of tall stature, with reddish or blond hair and dolichocephalic crania. An interesting portion of Dr. Collignon's memoir is where he points out the persistency of various physical types in portions of France for many centuries, even for thousands of years, as an examination of ancient sepulchres has proved.

MOTION AND HEAT.

[Continued from p. 135.]

BUT nature has other means of compensation for the molar motion converted into heat. Incalculable units of heat-energy are stored up in vegetable and animal organisms; and in evaporation still more countless units of heat-energy are converted first into molecular, and then into molar motion, in its most terrific forms.

Evaporation and the function it performs in the economy of nature are as yet little understood. It appears to be a form of expansion, and, like expansion, it increases with elevation of temperature; but it does not stop when expansion ceases, for it is well known that ice continues to evaporate below zero C.

It is undoubtedly the great instrumentality for converting heat into motion. It is constantly acting, and in the trade wind region eleven feet of the ocean's depth is annually lifted up and carried off by this silent process. Molecule by molecule the aqueous vapor is torn from the liquid mass, each one carrying or embodying so much heat and thus reducing temperature; in other words, each molecule moved in evaporation furnishes work in the form of motion for so much of the force or energy which was dynamic in the form of heat.

Molecular motion, evidenced by gaseous expansion in a closed vessel, is governed by the general laws of motion;[1] and it seems incredible and anomalous to hold that the inert molecule moved in evaporation, which unites with its fellows as aqueous vapor, and comes down again as rain, is not governed by the same laws of the motion which this force or energy, in the form of heat, imparts to it in the atmosphere.

If these laws of motion do apply to the motion imparted by converted heat to evaporated molecules, we have an origin for the trade winds far more simple than the generally supposed convection. The trade winds blow over the tropical water where convection is smallest, and not over tropical land, where it is greatest.

But it is sufficient for the present purpose to show that heat is converted into motion in the process of evaporation; and that even if the force or energy which, in the form of molar motion, is directly converted into heat by resistance, cannot be directly reconverted from heat into molar motion, there is in terrestrial nature a law of compensation which tends to convert any surplus of dynamic heat into dynamic motion, and thus preserve the equilibrium which has been observed.

Professor Tyndall has taught us how to trace radiant energy from one body to another, and how the dark or heat rays may be concentrated into the more intense light rays, after they have left the body which sent them forth. And Faraday, Joule, Mayer, Grove, and others have taught us the law of conservation, by which we know that this energy, when it disappears, is not annihilated, and when it reappears it is not a new creation. We see its manifestation in motion, molar and molecular; we feel it in heat, we see it in light and color, and hear it in sound. The motion may cease; light may be extinguished in darkness; colors may fade, and sound give place to profound silence; but the energy or force which caused all these phenomena was the same before they appeared as during their continuance, and its potential existence remains after their disappearance with the same measurable units as when it was dynamic, and subject to observation.

When the demon was cast out of the man and went into the swine, and they ran into the sea, it was the swine, and not the demon, who were drowned. He doubtless passed out into demon land, ready to again become dynamic when occasion offers.

This force, or energy, we are trying to trace, while dynamic, can only do so much work at one time. If it is entirely occupied in moving a mass, it cannot do other mechanical work; and if entirely occupied in molecular motion it cannot elevate temperature, nor become radiant as heat or light. And when rendered entirely potential, as when a ball thrown up is lodged on the roof of a house, or when heat becomes latent in liquefaction or evaporation, or when the sun's energy is locked up in the molecular structure of vegetable and animal organisms, it can do no work at all until again rendered dynamic. Its power and capacity when released is identically the same, neither more nor less, than when it was locked up. This is true whether it was locked up as motion or locked up as heat.

It has always seemed to me to be unfortunate and misleading that Professor Tyndall should have adopted "Heat a Mode of Motion" as the title of the book in which he gives to the world an account of his great and valuable researches in the delimitation of this force. Like the term "Mechanical Equivalent of Heat," it results from mistaking the thing done for the thing doing it, the effect for the cause. Heat is not a mode of motion, and it would be just as inaccurate to call gravity a mode of weight, or magnetism a mode of pull, and even less inaccurate to call motion a mode of heat. Motion and heat are forms or manifestations of the same force or energy, and when radiant, as heat and light, it is more nearly disconnected from ponderable matter than when it assumes the form of molar or molecular motion.

Motion, in all its forms, is the transference of material substance, ponderable or imponderable matter, from one place or part of space to another; it is the state of ponderable matter in which the forces acting on it are not in equi-

[1] "Molecular Motion in the Radiometer," etc., p. 16.

librium. *Rest* is the opposite of motion; it is the state of matter in which the physical forces acting on it are in equilibrium; that is when the force impelling motion in a given direction is counteracted by an equivalent force impelling motion in the opposite direction; or is resisted by a superior force. A stone *rests* on the surface of the earth because the force of gravity acting on the stone is resisted by the force of cohesion in solid matter; but the force continues although there is no motion resulting from it. The stone *sinks* in water, that is, it moves from the force of gravitation because the force of cohesion in the molecules of water is insufficient to counteract the force impelling motion; but when the force of cohesion in the molecules is sufficiently increased by congellation, the stone *rests* on the surface of the ice. So a top spun rapidly *rests* on its peg, because the force giving it horizontal motion counteracts the pull of gravity which causes it to fall when the rotation ceases.

Dr. Mayer defines force as "Something which is expended in producing motion; and this something which is expended is to be looked upon as a cause equivalent to the effect, namely to the motion produced."[1]

This is obviously too narrow to include even dynamic energy. Two horses pulling a vehicle in opposite directions with the same force would produce no motion; divide the force by unhitching one of the horses, and the vehicle moves. Then, according to this definition, we have the absurdity that the whole force is nothing, but half of it is something.

A correct definition of phpsical force is that it is something producing the state of ponderable matter in which it is subject to human observation. Whether the state be one of motion or rest, hot or cold, solid, liquid, gaseous, colored, etc., it is the result of force. We only know physical force from its effects on ponderable matter, and we only know ponderable matter as affected by force.

The supposed difficulty in the concept of an element in nature entirely distinct from, but inseparably connected with, ponderable matter, is entirely factitious. Time and space are such elements, entirely distinct from, and inseparably related to, ponderable matter; and the concept of force as above defined is as absolute and imperative as the concept of time, the concept of space, or the concept of matter itself. The progress of science in tracing a force through its various manifestations, as has been done to some extent with gravity, confirms the primal concept of force which comes with the very dawn of intelligence.

The still more abstract concept of law by which any force is what it is, is also primal, absolute, and inevitable in every human intelligence.

Whether all ponderable matter is one as claimed by some philosophers, or whether all force is one as claimed by other philosophers, are speculations which, with our present knowledge of these elements, are idle if not mischievous.

It is undoubtedly from phenomena resulting from the apparent differences in ponderable matter, and the apparent differences in the forces acting on it, that real progress in unravelling nature has been made.

We need a specific name for this force of which molar motion, molecular motion, heat, and light, are manifestations. There seems to be no doubt that positive electricity is also one of its forms. Electricity, like heat, is developed by friction and by chemical reaction; and its mechanical equivalent, or, more accurately, the electric equivalent of molar motion, doubtless is the same as the heat equivalent of molar motion, or differs from it by some law which will prove the identity of the force. Dr. Mayer suggested that whether friction, which of course is resisted molar motion, developed heat or electricity, depended on the character of the substances used in the friction, homogeneous substances developing heat and heterogeneous substances electricity. There appears to be no essential difference in the chemical reactions which develop heat and those which develop electricity; the difference apparently being in the mode of applying the force or energy and the substances to which it is applied.

Electricity passes from dynamic to potential under not precisely the same conditions as heat, but not more essentially different than the conditions under which motion passes from dynamic to potential, and its dynamic power is exhausted in doing work. This feature of electrical energy has been utilized by Mr. Hodges in his new lightning-rod, constructed of copper ribbon, so arranged that the copper will be dissipated by the electric current.

But I must leave this branch of the subject to those better informed as to the phenomena.

There may be still other forces, or rather forms of force, which may be found to have equivalence and mutual convertibility with heat. It is equivalence and mutual convertibility which warrants the assumption that motion and heat are phenomena resulting from, or, more accurately, are manifestations of, the same force.

In speaking of the force itself, I have used the expression "force or energy" because these words have several meanings, and the sense in which they are synonymous comes nearer the expression of the concept sought to be presented than any other phrase that has occurred to me. But it would facilitate induction if we could call it "Ergic Force," or "Ergism," or give it some other specific designation to distinguish it from other forces, or force generally, including under the term "Ergism" every manifestation of force for which a heat equivalent may be found. This name seems appropriate because it suggests the element in nature which is the basis of work It enables us to grasp a concept of the force distinct from its manifestation in any one of its forms; and if the delimitation itself is correct we can class as "Antergic" the forces, like cohesion, which have no heat equivalent, but which, under certain conditions, render dynamic "Ergism" potential.

DANIEL S. TROY.

[1] "Correlation and Conservation of Forces," D. Appleton & Co., 1890, p, 335.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

Further Notes on the Loup and Platte Rivers.

SEVERAL years since it was my privilege to spend several weeks studying the peculiar drainage of central Nebraska. I have therefore been much interested in the papers of Professors Hicks and Davis in recent numbers of *Science*. I trust I shall not be intruding if I call attention, at this time, to a few additional facts which seem to have a bearing on the discussion.

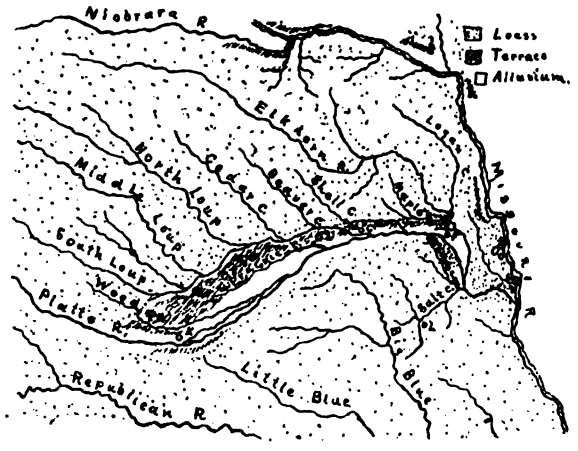
1. The streams north of the Platte, from Kearney to Fremont, have their courses first quite regularly south-east, then, as they near the Platte, they turn to the east-north-east, adopting the direction of that stream. Not only is this true of the Loup system, as Professor Hicks has well shown, but also of Shell Creek and Maple Creek further east.

2. There are dry channels, but little above the streams, connecting the Loup with Shell Creek, and Shell Creek with the Maple, which are known as Lost Creek and Dry Creek. These lie in the

same east-north-east direction, and are clearly analogous with the lower course of the Loup, where it connects its various branches. It seems not very improbable that the channel mentioned by Professor Hicks as connecting the South Loup with Wood River may be of the same sort.

3. The hills north of this compound channel, as it might be called, running parallel with the Platte, are of similar height and structure to those south of the Platte, but the hills south of the same channel are more than 100 feet lower, and of different structure. Both are capped with yellow loam of almost the same texture, but underneath the former have a well defined stratum of northern drift east of the meridian of Columbus, while the latter have but a faint trace of it mixed with deep stratified sand. These lower hills, moreover, are less eroded, and are evidently an alluvian terrace formed since the deposition of the older drift and the Loess. This terrace is seventy to ninety feet above the Platte, east of Columbus, and is more sandy and lower further west. The ancient north bank approaches the present Platte again, near Josselyn.

4. Corresponding in level to this high terrace, is an old channel crossing Saunders County along the valley of Sand Creek and in direct line with the upper course of the Maple. East of this is an area of higher land between it and the Platte, which has been recognized as an "ancient island." It may be added, also, that this high terrace seems to be easily correlated with a terrace of



Drainage Map of Eastern Nebraska.

similar height and structure, found at several points along the Missouri, which may be referred either to the "Second Glacial Epoch" or to the time of the second cluster of moraines of that epoch.

The subjoined map exhibits most of the points mentioned above, as well as some knowledge of the drainage, and indirectly of the topography of the surrounding region.

These facts point strongly to the efficiency of the second influence mentioned by Professor Hicks, viz., "Pliocene channel filling," as the principal and sufficient reason for the peculiar arrangement of the Loup channels, rather than a secondary influence. This has been already pointed out by Professor Davis. The Loups did formerly flow through to the Platte, but at a time when it or a portion of it occupied the north channel already described, and when it was flowing on a level seventy-five to a hundred feet higher, relatively, than at present, somewhat as it now occupies the channel north of Grand Island, and probably not long ago occupied a portion of Prairie Creek. The superabundant sediment, the shifting of the Platte to the south in obedience to Ferrel's law,—possibly reinforced by a tipping to the south,—and a deepening of its channel, which may have been partly due to a cutting through of a divide north of the "ancient island" into the lower channel of the Elkhorn, which, again, may have been accelerated by the recent eastward tipping of the region, are sufficient causes to explain the changes of the Platte, Loup, and associated streams since the disappearance of the waters which deposited the loess. The exceptional course of the Platte, however, from Kearney to Fremont, which we conceive was first taken about that time, remains unexplained. The causes which may be surmised are the following: 1. The position of a depression in the bottom of the Pliocene or Pleistocene lake, which may in some way have been produced by unequal deposition of its sediment, or the earlier unequal erosion or deposition of the subjacent formations whose strike here is approximately north-east. 2. A slight fold in the plains a little south of this course of the Platte. Of such no distinct trace has yet been found. There is a slight anticlinal axis crossing the Big Blue near Milford, but it is probably quite limited in extent. 3. This course may perhaps be a survival of a time when this region was tipped toward the north-east, because of the burden of ice which then rested upon Iowa, Minnesota, and eastern Dakota. This is but a conjecture, against which several objections arise, which it is needless to express.

In this connection, it may be helpful to call attention to a similar bend in the Arkansas in central Kansas, and to note that in each case the exceptional direction is upon more recent beds near, and parallel to their junction with, the upper Carboniferous. This may be a straw which would indicate that our first surmise may have some truth in it.

Concerning the efficiency of abstraction to change lines of superficial drainage, we may find considerable light from the study of this region. The remark of Professor Davis, that this rarely occurs where formations are nearly horizontal, seems well supported. Such is the slope of the country, and the porosity of the deposits, that the headwaters of the Big Blue rise a little below the level of the Platte adjacent, and the tributaries of Salt Creek rise below the level of the Big Blue near by, so that it is possible that water may leave the Platte between Kearney and Columbus, pass into the Blue, be drawn off into Salt Creek, and return to the Platte through the latter stream. And yet I know of no clear case of change of channel by abstraction in the whole region. The abundant sand, through the water flows underground, renders an open channel unnecessary. In fact, it may be argued that abundant sand tends to prevent the formation of superficial streams, unless there be first a velocity of flow sufficient to carry the sand easily, which cannot occur unless the flow is concentrated in some way. This is frequently noted in the sunken rivers of deserts. Possibly this may have had something to do with the exceptional course of the Platte before considered. Dunes form an important part of the divide between the Platte and the Little Blue south of Kearney.

One word further, regarding the comparative slopes of the Loup and Platte, to which Professor Hicks has called attention. Do we not find here examples of the law that declivity varies inversely as the quantity of water, as pointed out by Gilbert in his masterly paper on "Land Sculpture," in his report on the Henry Mountains? Although the Platte is much the more important river, by the time it has reached Kearney it is much reduced by evaporation and abstraction; then, because of its shutting off its tributaries by its abundant sediment, as before noticed, it is so reduced that it is often smaller than the Loup at their junction, even sometimes ceasing to flow above the surface, as I have been informed, while the Loup flows with a good current. On the other hand, the Loup is not so much exposed to evaporation, and has numerous tributaries, which having more frequently cut through the sand stratum, and on the lower side of its sloping basin, are more apt to be fed by springs than lose water by seepage.

J. E. TODD.

Tabor, Iowa, Feb. 29.

Estimates of Distance.

BESIDES the very interesting inferences drawn by Mr. Bostwick from his experiment (*Science*, Feb. 26, p. 118), one or two others should be suggested, in the hope that they may lead to some further investigation.

1. Is not an effect of fatigue shown in the eight or ten per cent by which the average observer's "mean deviation" from his own "average" is increased when the last ten of his thirty estimates are compared with the first ten? Should not this effect be greatest,—perhaps both appearing earliest and increasing most rapidly

with the number of observations made,— when the observer is quite untrained; while good previous mental training in things more or less analogous to those tested by the experiment might enable the observer to utilize promptly the practice being got in the experiment itself, and so might for a time overbalance the effect of fatigue? Thus, in the present case, the deviation increased most with the child A. L. B. and one other person, and decreased most with the artist L. F. and one other, but the data are too few to be more than suggestive. It would seem that further experiments upon the relation of fatigue, and of the effective practice got during each experiment, to previous training, etc., might be quite varied in direction and have some educational interest; the best training, *cæteris paribus*, being presumably that which best enables the trained to utilize fresh opportunities for training of a kind somewhat new to him.

2. The probable error of an estimated distance is, of course, some function of the distance and of other data; but *what* function of the distance, when the other data remain, as far as may be, constant? May it not be commonly taken as some low power of the distance whose exponent increases slowly with the distance? In the present case the ratio of the two distances tried is 4.37 : 1; and the average odserver's mean deviation in inches from the truth, and from his own average estimate, respectively, are 2.69 and 2 56 times greater for the long distance than for the short; so that the exponent here would not be far from $\frac{1}{2}$.

J. E. OLIVER.

Ithaca, N.Y., March 5.

Work and its Relation to Gaseous Compression and Expansion.

IT is quite well known that the fundamental, and perhaps the most important hypothesis in theoretical meteorology is this, that work is done by air in expanding, and that heat is evolved whenever air is compressed. See "Recent Advances in Meteorology," p. 41. There is a most serious fallacy in this theory, however, in that it ignores the resistance against which the air expands, and considers that the mere diminution of the distance of the molecules of a gas, without the direct expenditure of external energy in changing this distance, can evolve heat.

An illustration will serve to make this clear. Take a cylinder one square foot in area and two feet high with a piston at the top and the air beneath it at atmospheric pressure. Place weights, pound by pound upon the piston, allowing all the heat developed to escape into the outside air. When we have added 2,160 pounds, the air beneath will be compressed to two atmospheres. Fasten the piston and its load, and connect the cylinder with another holding one cubic foot and containing air at normal pressure. An equilibrium will be quickly established and the pressure will be at 1.5 atmospheres in each cylinder. The potential energy remains the same as before; no work has been done and therefore there has been no change in temperature, except a slight chilling and heating due to the rush of the air from one into the other.

Return to the cylinder with the air compressed to two atmospheres and having the same temperature as the outside air. Take off the weight from the piston pound by pound, and the air will gradually expand, and in doing so will lift a weight, thereby doing work which cools the air very greatly, about 50° F. if the initial temperature was 60°. Instead of taking off the weight pound by pound, however, suppose the whole 2,160 pounds had been removed instantly. The only resistance which kept the air compressed has been entirely removed, and it is very evident that the air would expand without doing any work, if we consider that the piston moves back slowly; or, in other words, if we neglect the resistance of the air to the rapid motion of the piston, and hence there would be only a very slight chilling, owing to the work of imparting a certain velocity to the particles rushing out. The same result would have been attained if we had fastened the piston and its load, and then had turned a stop-cock, allowing the air to escape into the atmosphere without making a noise.

I am well aware that the ordinary interpretation of this illustration is very different; for example, Tyndall, in his "Heat as a Mode of Motion," p. 64, in a somewhat similar discussion, says: "The gas, in this experiment, executes work. In expanding it has to overcome the downward pressure of the atmosphere, which amounts to 15 pounds on every square inch, and also the weight on the piston itself. It is just the same as what it would accomplish if the air in the upper part of the cylinder were entirely abolished, and the piston had a weight of 4,320 pounds." I do not see that this changes the aspect of the case at all. Suppose that the air were compressed to two atmospheres beneath the piston, and that that was loaded with 4,320 pounds, while a perfect vacuum existed in the upper part of the cylinder, suppose that we suddenly remove 2,160 pounds from the piston. The piston, still having a load of 2,160 pounds, would fly to the top of the cylinder. How much work has the air done in expanding from two atmospheres to one? None at all. It looks very much as though the compressed air must have lifted that weight, but a little reflection will show that this is not the case. The best way to understand it, perhaps, would be to think of the weight after it reached within .001 of an inch of the top of the cylinder. Here is a weight of 2,160 pounds with the air under it at atmospheric pressure; in one sense the air sustains the weight, but if the air at atmospheric pressure sustains the weight at this point (the top of the cylinder), then the air at the same pressure would have sustained it at the middle of the cylinder. In other words, if we had allowed the compressed air to escape when the piston was at the centre of the cylinder, still with its load of 2,160 pounds and with a perfect vacuum above, there would have been an equilibrium, and we could have pushed the weight up and down, allowing it to stand at any point so long as the outside air had a communication with the lower side of the piston. Does not all this show that the compressed air, considered by itself, did not support any part of the weight at the middle of the cylinder, but was free to expand without lifting any weight or doing any work?

We are strictly taught that the old idea, "nature abhors a vacuum," is not at all tenable; but if we lay aside strict analysis for a moment and resort to this view, I think it will make the situation plainer to us. To all intents and purposes, when our piston loaded with 2,160 pounds had a perfect vacuum above it, we may say that it was sustained by that vacuum, or, at least, that the compressed air had nothing to do in supporting it or in moving it to the top of the vacuum. This seems to be quite an intricate problem, but a little reflection will show that the piston loaded to 2,160 pounds, and having a perfect vacuum above it, with air having free access to its under side, is in precisely the condition it would be in if both ends of the cylinder were open to the air and the piston without weight were located at any point in the cylinder. In this case the piston may be pushed up and down without meeting any resistance except that to the flow of the air.

Consider now the question of heated air rising in the atmosphere. We may simplify the problem slightly by taking a balloon, having an infinitely flexible envelope and without weight. Empty the balloon, and tie the neck so that no air can enter. It would require a pull of 15 pounds to the square inch to separate the sides of the balloon, owing to the pressure of the air. Incredible as it may seem, this is the force which theoretical meteorology has introduced into every discussion of the dynamical heating and cooling of the air, and of the cooling and heating of masses of air as they ascend or descend in the atmosphere,— a force which it is no exaggeration to say is at least 25,000 times as great as that really exerted or developed. Inflate the balloon one-third full with hydrogen gas. The work required to do this is that needed to displace a volume of air equal to the volume of gas which enters the balloon, or it would be that of lifting a weight equal to 1.2 ounces per cubic foot half the height of the balloon. It will probably be said that the outside air helps in this inflation, and I grant that for argument's sake.

Let the neck of the balloon remain open to the outside air, and suppose that the gas can just lift a weight attached to the balloon. The balloon will rise in the atmosphere to a point where the pressure is 10″, or until the gas has expanded to fill the whole envelope. Since the work of the balloon is open to the air, the pressure inside will continue exactly the same as that outside. A little reflection will show, however, that the conditions would be

precisely the same whether the neck was opened or closed. The only work the gas would do in expanding would be that which it did in inflating the balloon, or it would simply displace a volume of gas equal to the enlarged volume of the balloon. It is easy to see that this work would be almost inappreciable.

It may help to clearness if we consider two balloons suspended by an endless rope passing over a pulley situated at the extreme height to which the balloon rises. This rope has no weight, and there is no friction at the pulley. One of the balloons is at the earth's surface, and the other at the highest point. The system is in equilibrium, and it would require but the slightest weight at the topmost balloon or a diminution of weight in the balloon at sea-level to disturb the equilibrium and cause the balloons to change places. It is very evident that throughout this motion the air sustains both balloons, and the work of expansion in one balloon or the work done by the air in compressing the gas in the other balloon would be almost inappreciable.

Instead of using hydrogen in our balloons we may use heated air and the results of the analysis would be exactly the same. Lastly, we may dispense with our envelope, and simply consider the heated air as rising in the atmosphere. As we have just seen, this air would do very little work, and the consequent cooling would be very slight; the converse would also be true, that the work of diminishing the distance between the molecules of the gas would be very slight, and the heating almost inappreciable so far as the compression was concerned.

The application of these views, if they shall be sustained, to nearly all theories in meteorology is very obvious. It has been only after the most careful study and analysis of all the questions involved, and a taking up and explaining all the apparent contradictions between the older views and these, that I have felt justified in presenting them so much in detail. I bespeak for them a most searching examination and criticism, hoping that thereby the whole truth may be established. H. A. HAZEN.

March 2.

Pyrite Incrustations of the Cretaceous Formations of Middlesex County, N.J.

ONE would scarcely expect to find beautiful mineralogical specimens in so uninviting a place as a clay pit. The specimens of pyrite incrusting wood and bark, that may be found in most of the clay pits of Middlesex County, N.J., are very beautiful, whether viewed æsthetically or as cabinet specimens. The incrustations as found near Ford's Corners occur in the black and dark-colored clays which usually overlie the lighter and better clays. This dark stratum of clay contains many remains of leaves, twigs, and bark, which have been partially changed into brown coal. Occasionally whole trunks are found which yield wood which may be wrought into a variety of ornamental objects which are capable of taking a good polish. As waters containing sulphates of iron come in contact with this carbonaceous matter the carbon unites with the oxygen of the sulphates and sulphide of iron is left in its place. In some specimens the pyrite is found covering the carbon, while in others the carbon has been completely replaced by pyrite; at the same time the form of the wood is perfectly retained.

Specimens having the form of twigs not thicker than a lead pencil, and having a fine crystalline surface, are occasionally found. These make very pretty breast-pins when suitably mounted. Some specimens look as though the material of which they were formed had been poured out whilst hot, and had spread on cooling much as hot lead does when poured out on a flat plate. Many specimens occur in the shape of balls as large as hen's eggs. These are made up of concentric layers of scale-like crystals formed about a nucleus at the centre. As these are exposed to the weather they scale off gradually, sometimes remaining bright until the balls disappear completely, while at other times they turn dark immediately.

The pyrite weathers very quickly when left exposed to the action of the air, and the clay waters. If, however, the specimens are collected and washed as soon as they are removed from their native beds, they will remain bright indefinitely.

Specimens are occasionally found weighing four or five pounds. When the pyrite is exposed to the weather in contact with sand or gravel, as the iron is changed to the ferric oxide it cements sand and gravel together so that very often the resulting conglomerate retains the form of the original lump of wood. Your clay-pitter does not look with a favorable eye on the "sulphur balls," as he calls them, for clay containing much sulphide of iron is worthless for brick-making.

Of late years large amounts of clay containing iron have been used for making the so called mottled bricks.

D. T. MARSHALL.

Metuchen, N.J., March 2.

AMONG THE PUBLISHERS.

THE American girl is not slow to grasp a chance. Some time ago *The Ladies' Home Journal* organized a free education system for girls, and the magazine is now educating some forty odd girls at Vassar and Wellesley Colleges, and at the Boston Conservatory of Music, all the expenses of the girls being paid by the *Journal*.

— The March number of *Babyhood* contains an article on "Getting the Teeth — First and Second," by the medical editor, Dr. L. M. Yale, which corrects certain misapprehensions as to the teething process and the troubles which are popularly supposed to accompany it. Similarly helpful medical articles are "The Care of Delicate Children," by Dr. H. D. Chapin, and "Cuts and Scratches," by Dr. H. Power. An alleged "sure cure" for diphtheria is also discussed by a competent writer. Of most general interest, perhaps, is a curious article on "What Shall be Done with Him?" — an account of a completely unmanageable though not at all vicious boy, which is sure to give rise to considerable discussion.

— We have received a copy of the American edition of "Longmans's New School Atlas," the joint work of George G. Chisholm of the Royal Geographical Society and C. H. Leete of the American Geographical Society. It contains thirty-eight double-page maps; but in many cases what is numbered as a single map is really a collection of two or three maps. The introductory maps illustrate the various physical and astronomical phenomena of the globe, the climates and vegetation of different regions and the distribution of races and religions, while the remainder of the book is mainly devoted to political geography. There are, however, several special maps illustrating the climate, geology, and industry of the United States and Canada, and one showing the several acquisitions of territory by the United States. Most of the maps are so colored as to show the elevation of the different sections of land above the level of the sea; which seems to us to be making too much of a very small matter. The selection of maps is very judicious, and the United States does not appear with such overweening importance as it does in most American atlases; though it receives as much attention as the British Empire, and much more than any other part of the world. The number of towns indicated on most of the maps is small; and though a school atlas ought not to be overburdened with town names, the present work would have been better if it had contained more of them. The maps are well engraved on excellent paper, and as a general atlas of the world for school use, the book is meritorious. It is published by Longmans, Green, & Co. of New York, at one dollar and a half.

— Professor David Starr Jordan makes the inspiring influence of a great teacher of science strongly felt in the account of "Agassiz at Penikese," with which he is to open the April *Popular Science Monthly*. The article contains many of Agassiz's own words, which reveal the master's spirit better than pages of description. An authentic account of what treatment the Catholic Church actually gave to Galileo and his discoveries and writings will be given by Dr. Andrew D. White in one of his Warfare of Science papers. Attempts have been made to disprove or explain away much of this ecclesiastical persecution, but Dr. White's statements are fortified by copious citations from authors of unquestioned orthodoxy, The same article tells just how far into

the present century the Catholic Church held to the notion that the earth does not move, and shows that certain Protestant sects displayed much less wisdom by clinging to the antiquated delusion even longer. "Rapid Transit" is the subject of the sixth of Carroll D. Wright's Lessons from the Census. It contains much information concerning operating expenses, relative economy of motive powers, growth of mileage, etc. An interesting study of "Involuntary Movements," by Professor Joseph Jastrow, will appear. Experiments have been made in the psychological laboratory of the University of Wisconsin which show the reality and nature of the motions on which "muscle-reading" depends. Professor Jastrow's article is illustrated with tracings of such movements, and with a figure of the simple apparatus employed in taking them. "The Great Earthquake of Port Royal," which took place in 1692, will be described by Colonel A. B. Ellis. This account corrects certain erroneous notions of the occurrence that have long prevailed, and shows that the arrangement of the present town invites a repetition of the catastrophe. The article is illustrated. The last of the articles on musical instruments in the series on the Development of American Industries will be published in the April number. It is by Daniel Spillane, and traces the evolution of the manufacture of "Orchestral Musical Instruments" in America. The article is fully illustrated.

— Charles Scribner's Sons will publish at once Edward Whymper's long-expected book, "Travels Amongst the Great Andes of the Equator," which was announced last fall, but which they were unable to issue at that time. They have in press a new "Handbook of Great Archæology" (profusely illustrated), dealing with vases, bronzes, gems, painting, sculpture, and architecture, by A. S. Murray, keeper of Greek and Roman antiquities, British Museum. After a long delay Baedeker's "Upper Egypt" has at last been published in English, and is imported by Charles Scribner's Sons. It will be welcomed by all interested in that subject, whether travellers or students.

— Houghton, Mifflin, & Co. have published a book by the theosophist, Mr. A P. Sinnett, on "The Rationale of Mesmerism." Mr. Sinnett is the author of "Esoteric Buddhism" and other works on theosophy, and in the present volume he professes to account for the phenomena of mesmerism, or hypnotism, on the principles of so-called occultism. He begins by rebuking the physicians and other scientific men for their refusal until very lately to study the phenomena in question or even to admit their existence; and it must be admitted that the rebuke is well deserved. The theories he advances to explain the phenomena are, however, of a very unscientific character. He asserts the existence of a magnetic fluid and also of a third principle in the nature of man, intermediate between the soul and the body, which he calls the "astral" principle; and it is by these imaginary agencies that he attempts to account for mesmerism. He tells us that there is an astral body, which "is quite visible when detached

CALENDAR OF SOCIETIES.

Biological Society, Washington.

March 5.—Fred V. Coville, Conditions affecting the Distribution of Plants in North America; Charles Hallock, The Physiology of a Pocoson; Vernon Bailey, The Homes of Our Mammals; Theo. Holm, The Flora of Nova Zembla.

Entomological Society, Washington.

March 8.—C. W. Stiles, The Histology of Ticks; T. N. Gill, The Larval Condition of Insects an Intercalated Stage.

Appalachian Mountain Club, Boston.

March 9.—Isaac Y. Chubbuck, Up North Tripyramid on Snow Shoes; Percival Lowell, An Ascent of Fuji.

Publications received at Editor's Office.

ARMSTRONG & NORTON. Laboratory Manual of Chemistry. New York, American Book Co. 8°. 144 p. 50 cents.

BLAIR, J. A. The Organic Analysis of Potable Drinking Waters. Philadelphia, P. Blakiston, Son & Co. 12°. 120 p.

BOWSER, EDWARD A. Academic Algebra. Boston, D. C. Heath & Co. 12°. 366 p. $1.25.

CHISHOLM AND LEETE. Longmans' New School Atlas. New York, Longmans, Green & Co. Imp. 8°. 88 Maps. $1.50.

CORNELL UNIVERSITY. Fourth Annual Report of Agricultural Experiment Station, 1891. Ithaca, The University. 8°. 499 p.

DORSEY, JAMES O. Omaha and Ponka Letters. Washington, Government. 8°. Paper. 127 p.

KARRER FELIX. Führer durch die Baumaterial-Sammlungdes k. k. naturhistorischar Hofmuseums in Wien. Wien, Eigenthum des Herausgebers. 12°. Paper. 355 p.

ORTON, EDWARD. Report on the Occurrence of Petroleum, Natural Gas and Asphalt Rock in Western Kentucky. Frankfort, Geological Survey. 8°. 288 p.

RUSSELL, STUART A. Electric Light Cables. London, Whittaker & Co. 12°. 382 p. Ill. $2.25.

SINNETT, A. P. The Rationale of Mesmerism. Boston, Houghton, Mifflin & Co. 16°. 239 p. $1.25.

TAYLOR, J. TRAILL. The Optics of Photography and Photographic Lenses. New York, Macmillan & Co. 16°. 254 p. $1.

THOMAS, CYRUS. Catalogue of Prehistoric Works East of the Rocky Mountains. Washington, Government. 8°. Paper. 246 p.

UNIVERSITY OF CALIFORNIA. Riverside Addresses, 1891. Berkely, The University. 16°. Paper. 74 p.

VERITY, JOHN B. Electricity up to Date. New York, Frederick Warne & Co. 18°. Paper. 178 p. 75 cents.

WINSLOW, ARTHUR. Report on the Coal Deposits of Missouri. Jefferson City, The Geological Survey. 8°. 296 p.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

For exchange.—A fine thirteen-keyed flute in leather covered case, for a photograph camera suitable for making lantern slides. Flute cost $27, and is nearly new. U. O. COX, Mankato, Minn.

To exchange; Experiment Station bulletins and reports for bulletins and reports not in my file. I will send list of what I have for exchange. P. H. ROLFS, Lake City, Florida.

Finished specimens of all colors of Vermont marble for fine fossils or crystals. Will be given only for valuable specimens because of the cost of polishing. GEO. W. PERRY, State Geologist, Rutland, Vt.

For exchange.—Three copies of "American State Papers Bearing on Sunday Legislation," 1891, $2.50, new and unused, for "The Sabbath," by Harmon Kingsbury, 1840; "The Sabbath," by A. A. Phelps, 1842; "History of the Institution of the Sabbath Day, Its Uses and Abuses," by W. L. Fisher, 1859; "Humorous Phases of the Law," by Irving Browne; or other works amounting to value of books exchanged, on the question of governmental legislation in reference to religion, personal liberty, etc. If preferred, I will sell "American State Papers," and buy other books on the subject. WILLIAM ADDISON BLAKELY, Chicago, Ill.

Wanted, in exchange for the following works, any standard works on Surgery and on Diseases of Children: Wilson's "American Ornithology," 3 vols.; Coues' "Birds of the Northwest" and "Birds of the Colorado Valley," 2 vols.; Minot's "Land and Game Birds of New England;" Samuels' "Our Northern and Eastern Birds;" all the Reports on the Birds of the Pacific R. R. Survey, bound in 2 vols., morocco; and a complete set of the Reports of the Arkansas Geological Survey. Please give editions and dates in corresponding. R. ELLSWORTH CALL, High School, Des Moines, Iowa.

For sale or exchange, LeConte, "Geology;" Quain, "Anatomy," 2 vols; Foster, "Physiology," Eng. edition; Shepard, Appleton, Elliott, and Stern, "Chemistry;" Jordan, "Manual of Vertebrates;" "International Scientists' Directory;" Vol. I. *Journal of Morphology;* Balfour, "Embryology," 2 vols.; Leidy, "Rhizopods;" *Science*, 18 vols., unbound. C. T. McCLINTOCK, Lexington, Ky.

To exchange Wright's "Ice Age in North America" and Le Conte's "Elements of Geology" (Copyright 1882) for "Darwinism," by A R. Wallace, "Origin of Species," by Darwin, "Descent of Man," by Darwin, "Man's Place in Nature," Huxley, "Mental Evolution in Animals," by Romanes, "Pre-Adamites," by Winchell. No books wanted except latest editions, and books in good condition. C. S. Brown, Jr., Vanderbilt University, Nashville, Tenn.

For Sale or Exchange for books a complete private chemical laboratory outfit. Includes large Becker balance (200g to 1-10mg), platinum dishes and crucibles, agate motors, glass-blowing apparatus, etc. For sale in part or whole. Also complete file of *Silliman's Journal*, 1820-1885 (62-71 bound); Smithsonian Reports, 1854-1883; U. S. Coast Survey, 1854-1869. Full particulars to enquirers. F. GARDINER, JR., Pomfret, Conn.

from the physical body to those who are gifted in any high degree with clairvoyant vision," and that "the astral plane affords direct communion between the consciousness of the operator and the subject when the two are brought into true magnetic harmony." This explanation, as our readers will see, is no explanation at all; yet it is not a whit worse than the theory of "multiple personality" which is advocated by many French and German hypnotists. In our opinion the phenomena in question are far too intricate to be accounted for by any principles now known to us, and we believe that much more investigation and far deeper thinking are necessary before the true explanation can be given.

— The Cassell Publishing Company announce the "Record of Scientific Progress for the year 1891," exhibiting the most important discoveries and improvements in all the branches of engineering, architecture and building, mining and metallurgy, the mechanic arts, industrial technology, and the useful arts, photography, chemistry, medicine and surgery, printing, the generation, measurement, transmission, and application of electricity, the telegraph and telephone, meteorology and aeronauty, astronomy, etc. The editor is Professor Robert Grimshaw.

— M. Camille Flammarion, the author of "Uranie," is too well known to need more than the announcement of a new volume from his pen to attract readers. His new story, "Lumen," announced by the Cassell Publishing Company, is very much in the manner of "Uranie," a scientific romance. "It is a delightful thing in these prosaic days," says a well-known critic, "to get away from the novels of realism and strike out into something of an entirely different order that lifts one into the clouds — the pun is unintentional — and takes him away from the earth. It is just this that M. Flammarion does and it is a rest to the weary brain to read his graceful stories." Mrs. Serrano, who translated "Uranie," has translated this volume.

SCIENCE

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

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SCIENCE

NEW YORK, MARCH 18, 1892.

THE PERSISTENCY OF FAMILY TRAITS.

NOT long ago we met a young friend, a bright, charming fellow, who said he was a student of ancestry. Having a weakness in that direction ourselves, we soon became engaged in conversation upon subjects of mutual interest until we remarked upon the extraordinary persistency of peculiar traits in members of the same family for long periods of time. To our astonishment he immediately informed us that the notion that there is such a thing as "family traits" had been consigned by all the leading genealogists to the realm of myths, and that there is positively no such thing to be met with in human experience. He proceeded to state that old people with active imaginations and defective sight and hearing thought they saw in their descendants the peculiar traits that in youth they had noted in their ancestors. Take from this, he says, the element of imagination, and there remains nothing but the recurrence of the traits of character common to humanity, and that once in a brief interval of time are emphasized in individuals.

He then produced a genealogical chart that showed the ancestors of A. B. through nine generations. A. B. was a direct descendant from L. B., who came from England early in the seventeenth century, about 250 years ago. The chart was of the usual semicircular form, with A. B. in the centre, and arranged in concentric semicircles, each semicircle devoted to a generation, with the right quadrant devoted to the ancestry on one side and the left quadrant devoted to those on the other. Of course, if such a chart was complete, as they very seldom are, the second semicircle would contain the names of two parents, the third of four grandparents, the fourth of eight great-grandparents, the fifth of sixteen, the sixth of thirty-two, the seventh of sixty-four, the eighth of one hundred and twenty-eight, and the ninth of two hundred and fifty-six. The whole number is five hundred and eleven individual ancestors of both sexes in nine generations. Assuming that no marriages took place between parties of even remote relationship, which is not likely to occur when the nine generations remain locally in the same neighborhood, the chart would show five hundred and ten ancestors, among which the direct line of B. comprised nine individuals, and occupied a perpendicular line in the centre of the chart.

"Now," says my friend triumphantly, "do you suppose that that line, mixed with nearly five hundred other lines, will preserve anything originally characteristic of it? The idea is preposterous." He continued further, "You will admit that ancestry consists of two elements, heredity and environment. In this case the environment has been the general conditions of New England farm and village life — practically the same; we can therefore leave that out. Now, heredity remains; do you suppose that anything peculiar remains in A. B. of any one of the two hundred and fifty ancestors from whom he is descended in the eighth generation from his own?" We answered, most emphatically, "Yes; and they would chiefly lie in the perpendicular line of B." To this declaration he dissented with equal emphasis, and appealed to the chart to prove it. We admitted that, as a geometrical demonstration, the chart was unanswerable, and urged without avail the fallacy of submitting a problem in biology and psychology to mathematical proof. The chart was, he assured us, the genealogist's compass and pole-star, from which there was no appeal.

Further conversation led to numerous citations of examples from our own knowledge and experience, which has been widely extended for many years among the descendants of John Doe. These examples, he assured us, were all mere coincidences that would cease to be examples beyond the range of the present generation; that, generally speaking, no man's knowledge extended beyond his grandfather, and that so-called family traits were eliminated by ignoring the great mass of dissimilars, and exaggerating the importance of the few similars. Finally, he challenged us to show that our examples proved anything beyond the observation of a few coincidences.

The problem briefly stated is this: Do persons bearing the same surname and remotely of the same family exhibit traits of character that are common, or in any sense to be considered as "family traits?" The facts within our observation and knowledge we believe to be susceptible of explanation upon a purely scientific basis of well-established principles, without any recourse to either imagination or chance coincidence. John Doe settled in one of the New England colonies about 250 years ago. The name is common among the middle-class English and is very old, one of the name having held a high ecclesiastical position in the thirteenth century, and others appearing among the lesser nobility a few centuries later. John Doe had a numerous family, of which five sons married, and have descendants now living in localities not far apart in New England and in many localities west of the Hudson River. There are descendants of these different brothers living as neighbors in several instances who do not know that they share a common ancestry. Now, it is or is not a matter of fact and observation whether these people, bearing a common surname and descended through from five to eight generations from a common ancestor, exhibit certain traits, or rather a combination of certain traits, which may be called in the aggregate a "Doe character." From our knowledge of the family taken as a whole, that is, the descendants of the five brothers taken together, we declare that there is an unmistakable "Doe character."

If you ask us to describe this character we must decline to do so. It is not necessary. Like all human character it is a mixture of good and bad. Moreover, it might be recognized, and we might be restrained from exhibiting our thesis with scientific clearness and precision. Again, there are subtle elements of human character that defy adequate expression in words, and yet are quickly recognized. Nevertheless, we will state how it has been proved to us as an individual: In the first place, by our own observation directed for several years by a knowledge of certain principles acquired in breeding animals; again by remarks made to us, neither solicited nor suggested by us, by members of the "Doe family," who had no knowledge of each other's exis-

tence, and who were separated by from five to seven generations; again, by similar judgments passed, not upon individual "Does," but upon the "Does" as a whole, by women who had married "Does," having no knowledge of each other's existence, and whose judgments had been passed upon different generations of "Does."

If "family traits" are a delusion to be explained away by the dilution of a geometrical chart amounting to one two hundred and fiftieth in eight generations, why can independent outside observers, the Does themselves and the women who marry Does, recognize a Doe character in the eighth generation? It is simply because heredity does not involve geometrical elements, in reality is only very inadequately represented by geometry.

Of what, then, does heredity consist? Of a vast number of extremely subtle influences determined by laws as yet but dimly comprehended, but few of which have as yet found adequate expression. Among others there are three laws or principles for which we do not know any name, but which, in their effects, are generally recognized among breeders of animals. First among these may be named the influence of race, which among breeders of animals would be equivalent to "a breed" and the varieties within it. A genealogical register of a family bearing a surname found among the seventeenth century settlers of New England may be fitly compared to the pedigree of any family of thoroughbreds, as, for instance, the St. Lamberts among Jerseys, or the Douglas among Ayrshires. It is often said that human beings are as to their breeding mongrels; but such a statement is not generally true, nor is it particularly true when applied to the better class of families who from the English middle class came to this country 250 years ago, and have here with a goodly showing of self-respect intermarried almost or quite exclusively in their own rank of social, religious, and political race. There has thus grown up under unwritten social customs a race, or breed, of New England citizens of pure English ancestry as carefully bred as to race and as to families within the race as any breed of thoroughbred cattle, a century older than the oldest breed in the world. Many of these families run back for several centuries in England before they emigrated to this country. We may, therefore, expect to find, and do find if we know where to look for them, the same effects of race that are observed in thoroughbred cattle, namely, persistency of race types as to the whole and of family types as to families. This persistency in the race is maintained through the persistency of the family type, and the family type is perpetuated by breeders through conformity with biological principles that, so far as is known, are active among all domesticated animals, and man considered as an animal.

It is a well-recognized fact that the first pregnancy of a female is of much greater importance as determining the character of her offspring than any and all others, and also that the influence of the male as determining the character of the offspring increases with each successive pregnancy of the female by the same male. Every breeder of cattle knows that a pure-bred heifer that is first coupled with a mongrel bull is ruined for breeding purposes, as the impression and characteristics of the first male will appear in the offspring of every succeeding pregnancy. A mare that is first coupled with a jack and gives birth to a mule will afterwards, when coupled with a stallion, give birth to horses with long ears and scant tails and saddle-marks across the shoulders and stripes upon the legs resembling mules. Horses marked in this way are very common in regions where mules are produced. A very handsome Morgan mare was once owned by an acquaintance of the writer that possessed unusual speed and great endurance. The condition of her udder showed that she had once borne a foal. She was coupled with a very fine thoroughbred stallion, and brought forth a perfectly worthless Canadian scrub, without a single characteristic of either parent.

Among human beings the infrequent marriage of widows as compared with the whole number of marriages renders a reference to examples in demonstration of this law of heredity somewhat difficult. Cases are not wanting, however, where women of high character have unfortunately married profligate first husbands, and have sought in a second marriage with men of honor to realize the happiness of which they had been deprived, only to see in bitterness the vices of the first husband return to curse them in the offspring of the second union. In less unfortunate marriages of this character the father fails to recognize in the aliens around his board either the virtues or vices of his kindred, and the personal appearance of his children is as foreign as their other characteristics.

The conditions under which animals are bred offer but few opportunities to demonstrate the increasing influence of the same male through successive impregnation of the same female. Among human beings illustrations are very numerous. Certain aspects of this case — perhaps the lowest — the marriage of colored women with white men and colored men with white women, are the most remarkable. Among the children of such unions the influence of the white man upon the colored woman produces a series of types with more or less strongly marked negro features and a successively lighter skin until a nearly white negro is produced, an example of which we once saw in Louisville, Ky., much more repulsive in appearance than a veritable negro. When a colored man marries a white woman a series of increasingly black children is the result. The children of such unions are in every sense mongrels, and are found to resemble in many respects mongrels among animals.

In every family that can be studied in successive generations the action of this principle explains many seemingly inexplicable facts. To go back to the descendants of John Doe, we have asserted without any fear of possible contradiction that there are "family traits" that may be observed among those who are separated from a common ancestor by six or seven generations. In one case among them a most extraordinary personal likeness was preserved through three generations. They were the fifth, sixth, and seventh generations from John Doe; they were the fifth, third, and fourth children of their respective parents. In the eighth generation the type was continued in the first child, but it is much less marked, and in the ninth generation, the son being the second child, with the influence of the mother very strong. Still, in both the eighth and ninth generations the Doe traits are unmistakably present. In the ninth generation the fourth child is a daughter, and generally admitted to be a Doe in every fibre of her being. Here is another case from the Does. In the sixth, seventh, eighth, and ninth generations a daughter has appeared in the relations of niece, aunt, great-aunt, and great-great-aunt. We have known them all. In the sixth generation she was the second child, in the seventh the sixth child, in the eighth the fifth child, and in the ninth the third child. They were and are all lighter in complexion than the others of their respective families, with a peculiar cast of features, resembling each other more than they resemble their mothers or sisters. They

also possessed in common certain temperamental peculiarities, and their voices would instantly remind the hearer of each other.

Now to go back to our friend's chart, where the perpendicular line represents nine successive male Does. If every one of these eight male Does was a first child of each successive marriage, the Doe influence would be at a minimum and the transmission of the peculiar traits of the Does most feeble and uncertain. If each one of the eight was the youngest child in a family of six, the persistency of Doe traits would become more intense with each successive generation. For some purposes the tradition of the seventh son of the seventh son becomes something more than a mere superstition. If, however, in the third or fourth generation the surname was transmitted by a son whose father was the second husband of a widow who had borne children by a former husband, the family traits of the Does would doubtless be conspicuous by their absence. There have been no such marriages in the line of Does above mentioned for eight generations.

Too little is known concerning this subtle and intricate question to enable one to venture an estimate of the percentage of tendency towards family traits along the line of nine Does as compared with any other line from any given individual of the two hundred and fifty of the first generation from the ninth; but we think the challenge of our friend has been accepted and met, and sufficient proof has been submitted to show to any candid mind that a vastly greater proportion than one two hundred and fiftieth may be expected to flow along the line represented by the eight individuals who transmit the surname from the first to the ninth generations. Indeed, we think we are treading on solid ground when we assert that in the letters written by the Doe who was an ecclesiastic of the thirteenth century, and which have come down through six hundred years to the present time, the "Doe traits" are strikingly evident.

We should be gratified to learn if others familiar with other families than the Does are not fully satisfied that "family traits" are very persistent along the line of the surname.

AN ENQUIRER.

"SCIENTIFIC" GENEALOGY — A REJOINDER.

FROM the commencement of interest in the history of old American families the marked tendency has been, and is, for the chronicler to depart from the strict records, and attempt to trace reputed traits and oftentimes marked physical characteristics of the original emigrant ancestor and founder of the family through eight and nine generations, and connect the aforesaid qualities with the persons now bearing the surname descended from him. And a pride in one's ancestry is not reprehensible so far as these ancestors were healthy, energetic, honorable citizens, not less as honoring them than as taking satisfaction in the probably clear minds and strong constitutions we inherit, barring an untoward environment. But where the historian, considering a living person's little tricks of habit, peculiarities of appearance, and the like, ascribes these as in fact undoubtedly inherited from the original ancestor of nine generations previous, it becomes necessary to direct the attention of the sincere seeker for truth to certain self-evident truths, which are none the less patent and far-reaching, if comparatively unheeded and little studied in the past. To instance an average case: John Brown is a living person of the ninth generation from the first James Brown, who, we will suppose, came to this country about 1630. A simple mathematical computation shows that John Brown has had 510 distinct ancestors in these generations, of whom, at a liberal estimate, 50 may be duplicates owing to intermarriage of relatives. If there is a person in New England who can state his ancestry since 1630 completely with proofs, the writer, after some years careful research and acquaintance with men pursuing such study, has failed to discover him. As a matter of fact, the genealogist who has discovered and proved half his grandparents is exceedingly uncommon, and probably not one-twentieth of the persons who have chronicled the genealogy of a surname have known over 50 of their ancestors. They have paid, usually, almost their entire attention to the one surname in which they were interested and which filled their mind to the exclusion of the greater number.

In the writer's opinion he probably inherits from the 256 emigrant ancestors such a blending of qualities and physical characteristics, that to ascribe peculiar traits of any particular one of them to a living descendant is a fallacy, unsupported by reliable circumstantial evidence and persisted in in spite of the fact that the 255 other ancestors of the first American generation had qualities and traits of which he knows nothing, nor even the names of most; and probably, as far as the historian can surmise, each of the other 255 were fully as instrumental in bequeathing peculiar qualities, etc., as the one whose surname sexual distinction has given him. How does the matter look faced in the following manner? James Brown was one of 256 of John Brown's original American ancestors; is it likely or probable or a desirable thing for a genealogist to prove that $\frac{1}{256}$ part of the whole, when, as far as mortal can tell, all had probably much the same influence on the descendant, that this $\frac{1}{256}$ part has determined in a prominent and noticeable way the identity of the descendant? If one of the 256 were a person of color, an African, in the fourth generation, much more the ninth, the scientists tell us the color trace is well-nigh obliterated as far as discoverable. The writer does not for a moment combat the well exhibited inheritance of peculiar appearance and traits of a man from his father or mother, his grandparents or great-grandparents, or in rare cases from great-great-grandparents, but beyond these limits the historian has little to encourage him in his attempt beyond uncertain and traditionary tales.

The writer is descended from two ancestors, for both of whom the respective historians have claimed qualities and pronounced appearances of person, and remarked them prominently in all the living descendants; and the writer as yet fails to discover, after a candid if somewhat anxious self-examination, any of these characteristics. How often the mother's relatives fondly see clearly her look, her habits and character in a child for whom the father's family claim the self-same points; and the writer is familiar with the facts in a case where well-meaning friends have told parents of the strong likeness a child bore them, not knowing the child to be of entirely foreign parentage — adopted. My experience has been that a good part of the grounds for the side of the question I disbelieve in are as insecure as those just instanced. It is an old saying that one finds what he seeks for: that is, he thinks he finds it, which answers the same purpose for him.

To compare the human race to any of the brute creation as regards this question is unjust and mistaken, as in selection, cohabitation, and kindred vital processes, the cow — for instance, of Jersey or other strain — has the advantage of careful and long-continued selected inbreeding, where the human being is the result (even for nine generations) of over

four hundred different stocks as against a very few mated in the case of the cow.

Such deductions as the writer opposes are, in his opinion, misleading, rest on unstable bases, namely, imagination and tradition, and are better avoided and the time better spent in legitimate genealogical work. To eke out with such matter what is feared will otherwise prove dry and without interest is unscientific and wrong. With the belief that this review, though hasty, may appeal to the common sense of the conscientious reader the subject is left, the writer believing a simple brief statement of fact preferable to a long and confusing rehash of unnecessary arguments.

VERITAS.

A COMPARISON OF THE DESERTS OF NORTH AMERICA WITH THOSE OF NORTH AFRICA AND NORTHERN INDIA.

In a paper read before the Geographical Society of Berlin Jan. 2, Professor Johannes Walther made some interesting observations on the deserts of North America, North Africa, and Northern India. It was with the object of being able, from his own observations, to institute a comparison between these deserts that the author took the opportunity afforded by the meeting of the Fifth International Congress of Geologists of visiting the North American deserts.

The most striking contrast between the North American deserts and those of north Africa consists in the far greater wealth of vegetation which characterizes the former. In every direction the eye is met by yellow blossoming halophytæ, silver-gray artemisiæ, and prickly cacti; between the opuntias are found cushions of moss, and at the foot of the hills juniper-trees seven feet high with trunks a foot thick. Such are the features of the landscape of the deserts of Utah, where plant-growth has completely disappeared only in those places where the saline composition of the soil kills vegetation. The Van Horn deserts in western Texas, the Gila deserts in California, are equally rich in vegetation; the altitude of those deserts above the sea level makes no important difference. Either the mean rainfall in the American deserts is greater than in those of Africa, or else the flora of the American deserts is better adapted to a dry atmosphere. Although the deserts of the two continents present fundamental differences as regards vegetation, there is a surprising similarity between them as regards certain important and characteristic desert phenomena, especially with regard to the topography of the country. There is the prevalence of plains, with mountains rising from them like islands, with no intervening heaps of *débris* passing from the plains to the steep mountain slopes. This phenomenon is the more striking as there are no rubbish deltas, even at the outlet of valleys 1,000 feet in depth. Another feature common to both is the large number of isolated "island" mountains and of amphitheatre formations in the valleys; also the intensive effect of insolation, which splits the rocks and flints, and disintegrates the granite into rubbish. The denudating influence of the wind is visible not only in the characteristics of the surface forms just mentioned, which differ in important points from erosion forms, but it can be directly observed in the mighty dust-storms which rush through the desert. In North America, as in north Africa, four types of denudation products are found — gravel beds, sand dunes, loam regions, and salt deposits.

In view of such agreement of important and incidental geological phenomena in regions so remote from each other, the phenomenon of desert formation must be considered to be a telluric process which runs its course according to law, just as the glacial phenomena of the polar zone or cumulative disintegration in the tropics. Water, which is such a predominating influence in temperate regions, destroying the rocks, dissolving them chemically, while the frost pounds them up mechanically, has in the deserts about sixty days in the course of the year to do its work of destruction among the rocks and to carry away *débris*. During the remaining 300 days of the year denudation in the desert is at a standstill, but not entirely. Small and large stones are split by the heat, and huge granite blocks are severed in two by immense fissures; and thus the rocks are destroyed by dry heat at a time when denudation by means of water is reduced to a minimum. In this way the process of destruction goes on in one form or other uninterruptedly throughout the whole year. The disintegrated material is then carried away by the desert rains or by the storms, which whirl great masses of loose matter high into the air and transport it further. It is clear, therefore, that dry denudation possesses an intensive power which, although not equal to the denuding effect of water, may be compared with it.

NOTES AND NEWS.

In the death of Thomas Hockley, which occurred on the 12th of March, in Philadelphia, the scientific institutions in that city have suffered a serious loss. Mr. Hockley was a member of nearly all the local learned societies, and as an officer of many of them did much to promote scientific work. As treasurer of the University Archæological Association, the Department of Archæology of the University of Pennsylvania, the Numismatic and Antiquarian Society, as well as of the Zoological Society and the Fairmount Park Art Association, he gave his services without pecuniary profit or even the prominence which he deserved, and he will be remembered as one who did much to advance public interests through self-sacrificing devotion to the general good.

— At the Berlin Geographical Society, on Jan. 2, Herr L. Cremer read a report upon the journey undertaken by him in the summer of 1891 to Spitzbergen, with the object of exploring the coal beds there. The author in the course of his six weeks' journey travelled along the west coast as far as Magdalena Bay, and found, besides the coal beds in Ice Fjord and Bell Sound, which were discovered by Swedish explorers, various other coal-veins which appear to be well worth working.

— In the second lecture of the Lecture Association of the University of Pennsylvania's course on "Early Religious Ideas," on Feb. 28, Mrs. Cornelius Stevenson spoke as follows: "The primitive animism of the men of the age of stone always remained at the foundation of the religion of Egypt, and continued to develop its superstitious practices, whilst the national faith had assumed an ever-growing metaphysical character. At the opening of history the Egyptians had already recognized the unity of the life-giving principle, but whatever may have been the ideas of their advanced thinkers with regard to the nature of the unity, there is no doubt that, to each local worshipper, the god he prayed to was strictly the god worshipped in his locality — and this did not exclude the recognition of the other gods. The whole structure of the Egyptian religion rested upon a belief in the divine nature of life, and, in its immortality through transformation, man could attain his immortality, not (in early times) through his merits, but through physical means. Hence the precautions taken to preserve the remains, and the statues made in his image, on which the spirit might lean in case his body should be destroyed. Metaphysical speculation on the nature of the universal soul grew out of solar worship, and, influenced by Aryan contact, at last superseded it. But even then the primitive animism, preserved in the cultus of the sacred animals regarded as incarnations of the divinity, although it assumed in the sanctuary a symbolic char-

acter, took a larger place than ever in the popular religion, and so it came to pass that fetishism was never more conspicuous in Egypt than at the time when the ideal absolute God, 'self-begotten,' had been realized in man's most noble thoughts, and been fitly described in man's most noble words."

— The death, on Feb. 20, of Professor Hermann Kopp is announced by *Nature*. He died at Heidelberg, after a long and painful illness, in the seventy-fifth year of his age.

— The friends of the late Henry Edwards have subscribed $10,000 and the American Museum of Natural History has subscribed $5,000 for the purchase of the Edwards Entomological Collection, consisting of more than 350,000 beautiful specimens of insect life, and this scientific treasure goes to the American Museum. The widow of Mr. Edwards will receive $15,000. This enterprise has been carried through by A. M. Palmer, and is one of the many good works done by that energetic manager and public spirited citizen of New-York.

— Two international scientific congresses are to be held at Moscow in August, as we learn from *Nature*. One will relate to anthropology and archæology, the other to zoology. There will be exhibitions in connection with both congresses, and appeals have been issued for the loan of objects which are likely to be useful and interesting. Among the things wanted for the Anthropological Congress are phonograms of the language and songs of different races. French will be the official language of the two meetings. The more important papers will be printed before members come together, so that discussion may be facilitated.

— The prevalent notion that the mistletoe is injurious to the apple or other tree on which it grows is disputed, says *Nature*, by Dr. G. Bonnier, the professor of botany at the Paris Sorbonne, who maintains, not only that this is not the case, but that it is actually beneficial to its host, the relationship being not one of simple parasitism, but rather one of symbiosis. He determined from a series of observations on the increase in the dry weight of the leaves, that, while in summer the mistletoe derives a large portion of its nutriment from the host, in winter these conditions are reversed, and the increase in weight of the mistletoe is less than the amount of carbon which it has obtained from the atmosphere — in other words, that it gives up to its host a portion of its assimilated substance.

— In order that the exhibition of weeds at the World's Columbian Exposition may be large and representative of all sections of the country, Byron D. Halsted, New Brunswick, N.J., having this feature in charge, asks for specimens of the worst weeds from all States and Territories. It is suggested that each botanist or local collector who may be pleased to assist in the work secure at least three specimens each of the worst weeds in his State or section. In making the specimens it is important that the following points be considered: 1. Seeds are especially desired; 2. seedlings are important in various stages of development; 3. the root system is essential, also, 4, the flower and flower cluster, and 5, the seed vessel. It may be necessary, therefore, to secure these various essentials at different times during the coming season. If the weed is a large one, stress is laid upon the procuring of specimens while they are small enough so that the whole plant, roots and all, can be mounted without bending upon an herbarian sheet of ordinary size; that is, not over a foot in length. They are not to be mounted, however, by the collector. That unnecessary duplication may be avoided, persons who contemplate collecting specimens should signify their intention to Professor Halsted, and allotments will then be made, the assignments depending largely upon the locality. It is hoped that each State in the Union may be represented by specimens in this national exhibit of our worst weeds. The collecting must all be done during the present season, and the specimens sent in for mounting, labelling, etc., by Dec. 1.

— The January number of *Petermann's Mitteilungen* contains an interesting map, by Dr. E. Hahn, of the "Kulturformen" of the earth, showing the areas within which different methods of getting a living out of the soil are employed. Dr. Hahn discards the old-fashioned division into hunters, fishermen, shepherds, and agriculturists as containing a fundamental error; for these three successive "stages" he substitutes six "forms." The simpler forms may have been more widely spread in the earlier periods of the world's history, but all exist side by side at the present time, as methods of cultivation arising from the physical and climatic conditions of the regions in which each is employed. The simplest form is hunting and fishing. The large area which Dr. Hahn assigns to this form in North-eastern Europe and Asia is somewhat remarkable. Next comes what Dr. Hahn calls Hackbau, which we may translate by hand-tillage. This form is characteristic of Central America, the basins of the Orinoco and Amazons, tropical Africa, Further India, and the Malay Archipelago, with the exception of certain coast districts. Plantations, the third form, are found wherever coffee, rice, sugar, are grown on a large scale. Next comes what Dr. Hahn calls "our European and West Asiatic agriculture," characterized by the use of the plough, the employment of oxen as beasts of burden, and the growing of corn. Originating in Mesopotamia, this form has spread with but slight changes over all the more civilised parts of the world. With regard to the fifth form, cattle farming, Dr. Hahn states that the only circumstance which was considered characteristic of the shepherd's life was the fact of his being a nomad. This excluded all whose herds consisted of other animals than sheep or goats. Larger cattle require better food than could always be obtained on the march. He therefore puts all owners of herds in one category, whether nomads or settlers. They are spread over all Central and Northern Asia, and are found in Arabia, on the borders of the Sahara, in South Africa, and in certain portions of Northern Europe, America, and Australia. A curious feature is a long, narrow strip extending from Somaliland into South Africa at varying distances from the East Coast; by his own account, however, it should not have been reckoned to the cattle-farming regions, as the cowherds make little or no use of the milk given by their animals, which are looked upon as mere standards of value and wealth. The last is the elaborate form of cultivation in small plots, which is the only method by which the exhausted soil of China can be got to maintain its huge population.

— Dr. Ira Remsen, professor of chemistry in Johns Hopkins University, Mar. 11, addressed a communication to President Harper of the Chicago University, declining his invitation to a professorship in that institution. Professor Remsen's decision is the cause of great gratification in Baltimore university circles.

— Dr. C. W. Stiles, medical zoologist of the U. S. Department of Agriculture, has been elected foreign corresponding member of the Société de Biologie, Paris, France, to fill the vacancy caused by the death of Professor Joseph Leidy of the University of Pennsylvania.

— Joel Chandler Harris's new book, "On the Plantation," is said to contain fresh stories of Brer Rabbit, Brer Owl, Brer Buzzard, and other characters immortalized in "Uncle Remus." Much of the book, however, is understood to be the story of the author's own life, and it is described as a singularly fascinating narrative. E. W. Kemble has illustrated the book, which is to be published immediately by D. Appleton & Co.

— E & J. B. Young & Co. of New York have sent us a copy of the "Star Atlas," for amateur astronomers, with explanatory text by Dr. Hermann J. Klein, and translated and adapted for English readers by Edmund McClure, M.A., M.R.I.A. It contains eighteen maps printed by E. A. Funke, Leipsic, and is published, under the direction of the Committee of General Literature and Education appointed by the Society for Promoting Christian Knowledge, London, at the low price of three dollars. The maps show all the stars from 1 to 6.5 magnitude between the North Pole and 34° south declination, and all nebulæ and star clusters in the same region which are visible in telescopes of moderate powers. The "Atlas" is an imperial 4°, strongly bound in cloth, with illuminated cover, and contains 72 pages of descriptive text, with 18 charts beautifully printed from heliographical reproductions of photographs. It is a model of its kind, being handy, compact, accurate, and of practical service to amateurs, comet-hunters, and students.

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Attention is called to the "Wants" column. It is invaluable to those who use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

For Advertising Rates apply to HENRY F. TAYLOR, 47 Lafayette Place, New York.

THE NEW STAR IN AURIGA.

ON Feb. 2 of the present year Professor Copeland of the Edinburgh Observatory received an anonymous postal card upon which was written the following: "Nora in Auriga, in Milky Way, about two degrees south of Chi Aurigæ, preceding 26 Aurigæ; fifth magnitude, slightly brighter than Chi,"

In No. 1,164 of *Nature* the discoverer of the new star establishes his identity by a short notice of the manner in which he found the Nora. His name is Thomas D. Anderson, and he lives in Edinburgh, Scotland. The following is an abbreviation of his statement: —

"It (the star) was visible as a star of the fifth magnitude for two or three days, very probably even for a week, before Professor Copeland received my postal card. I am almost certain that at two o'clock on the morning of Sunday, January 24, I saw a fifth magnitude star making a large obtuse angle with Beta Tauri and Chi Aurigæ, and I am positive that I saw it at least twice subsequently during that week. Unfortunately, I mistook it on each occasion for 26 Aurigæ, merely remarking to myself that 26 was a much brighter star than I used to think it. It was only on the morning of Sunday, the 31st of January, that I satisfied myself that it was a strange body."

Mr. Anderson then, in a frank manner, speaks of his knowledge of astronomy and the instrumental means at his disposal Of the former he says, it is of meagrest description, while the latter consist of a pocket telescope and a copy of Klein's "Star Atlas."

Since discovery the new star has been very generally observed at all the prominent observatories in Europe and America. The telegram announcing the discovery was received at the Naval Observatory on the afternoon of February 6. I observed the star the same evening with our 4-inch comet-seeker. To me it then appeared about half a magnitude brighter than Chi, and was of a dark straw color. Using a low-power eye-piece, I could bring both Chi and the new star into the field at the same time. With the meridian transit I observed the star for its Right Ascension, and Professor Frisby, with the 9-inch equatorial, determined its declination. The large transit circle is now dismounted, undergoing repairs prior to its removal to the new Observatory. The place of the star for 1892.0 is, R.A. 5 h. 25 m. 3.4 s.; Dec. +30° 21′ 41.0″. The magnitude was 4.6.

Professor Copeland, upon examining the star with a prism between the eye and the eye-piece of the 24-inch reflector, observed that it seemed to possess a spectrum very much like that of the Nora of 1886, the recoguized variable, named Tau Coronæ.

The star was photographed at Harvard College Observatory on Dec. 1, 10, and 20, two months before it was known to be a new star. This came about by Prosessor Pickering and his assistants photographing the region of the sky in which the Nora is located in the course of the photographic mapping of the stars and their spectra now being carried on at Harvard College Observatory. On the 1st of December, 1891, the Nora was faint, on December 10 bright, and on the 20th maximum. Spectrum unique. The above is a statement given out by Professor Pickering.

From No. 3,076 of the *Astronomische Nachrichten* we glean the following interesting points relative to the new star. At Bonn, Feb. 2, Professor Kustner made a careful comparison of the magnitude of the Nora with three neighboring stars. He estimated it as half a magnitude fainter than Chi, little, if any, brighter than 14 Aurigæ, and decidedly brighter than 26 Aurigæ, the resulting magnitude being 5.5.

The region of the sky in which the new star is located was examined for the Bonn Durchmusterung by Schonfeld, March 26, 1856, and Kreuger, Feb. 16, 1857; also again by Kreuger in the revision-zone, March 23, 1858, on which date he observed a star of the 9.5 magnitude distant from the place of the new star 2.5s. and 0.8′. This faint star has, however, been observed anew at Bonn and Hamburg.

At Upsala on Feb. 2 its magnitude was estimated as 5.5, and its color as yellow. On observing its spectrum a very bright line was seen at the red end, and another in the blue-green. On Feb. 3 the star was almost as bright as Chi, but the next night it was fainter.

At Kiel, Mr. Kroeger observed the spectrum on Feb. 2. It was brilliant and visible throughout all the colors from the red far into the violet. A broad, black band was seen near C. In the red and orange there were three groups of lines, separated by equal intervals and of nearly equal width and intensity, all wide, but faint.

Mr. Yendell, living near Boston and an expert in variable star observing, is authority for the statement that between Feb. 9 and 22 the star appeared to him of a bluish white color with no tinge of red. This observation of the color of the star is directly opposite to that reported by the English and German observers, and also that of mine made on several occasions. The star has each time that I have observed it, ten or twelve times, always appeared to me of a dark straw color. I have observed it with two instruments, the 4-inch comet-seeker and the meridian transit. Mr. Lockyer, the English spectroscopist, has secured several photographs of the spectrum. He estimated the color of the star as reddish with a purple tinge. Mr. Fowler, one of his assistants, estimates it as reddish yellow; while another, Mr. Baxaudall, estimates it as purplish.

Mr. Lockyer, commenting upon the photographs taken on Feb. 7, says, "The bright lines *K*, *H*, *h*, and *G* are accom-

panied by dark lines on their more refrangible sides. With the 10-inch refractor and Maclean spectroscope, C was seen to be very brilliant, and there were four very conspicuous lines in the green. Several fainter lines were also seen, and a dark line was suspected in the orange. Mr. Lockyer noticed that some of the lines, especially the bright ones near *F* on the less refrangible side, appeared to change rapidly in relative brightness, and this was confirmed by Mr. Fowler. All the lines in the spectrum of the Nora are broad, although in a photograph of the spectrum of Arcturus, taken with the same instrumental conditions, the lines were perfectly sharp. It is also important to note that the broadening of the lines is not accompanied by any falling off of intensity at the edges, as in the case of the hydrogen lines in such a star as Sirius.

Judging from the testimony here given, it is undoubtedly true that a new star has appeared to our vision, and given astronomers an opportunity to study its make-up. It cannot, however, be said that the object has suddenly come out to its present magnitude. The probability points to the fact that the new star is a variable of long period, and one that at its minimum sinks to invisibility. The verification of this statement must rest upon future observations. We have no record that indicates that a star as bright as the tenth magnitude has ever occupied the place in which the new star has been found. All speculation as to its future history is valueless, because we know nothing of its past history.

The star is now being constantly watched by all the powerful telescopes and spectroscopes of the world, its image is almost nightly caught upon the photographic plate handled by men of experience, and it will not sink back into invisibility without leaving behind a record of great value.

GEO. A. HILL.

Washington, D.C., March 9.

THE TIMBER TREES OF WEST VIRGINIA.

THE Guyandot Coal Land Association, which is the owner of over 200,000 acres of land in the basins of the Guyandot and Twelve-Pole Rivers, in the Counties of Wayne, Logan, and Lincoln, near the south-west corner of West Virginia, has recently had the large timber trees on about 9,000 acres of land counted and measured, thus securing reliable information as to the actual present condition of the Trans-appalachian forests of that region. The diameter of the trees was taken, with calipers, at about four feet above the ground; then the length of the trunks suitable for cutting into logs or for long timber was carefully estimated by the eye of the skilful timber measurer. No trees were measured that were less than eighteen inches in diameter, except the hickories and locusts, which were measured from ten inches and upward. The detailed tables of this counting and measuring have been furnished me for inspection. I think that a summary of the detailed count of the results of the measurements on one single tract will be of interest to the readers of *Science*. For this purpose I select a tract of 655 acres on the top of the dividing ridge between the waters of the east and the west forks of Twelve-Pole River, two miles north-east of the new mining town of Dunlow on the Ohio extension of the Norfolk and Western Railroad, about forty miles by rail south-east from the Ohio River at the new town of Kenova, one named from the abbreviation names of the three States that are there adjacent.

About one-half of this particular tract of land, say 325 acres, lies on the east side of the dividing ridge, slopes from the divide and faces to the north of east, and drains into East Twelve-Pole River. The other 325 acres lies on the west side of the divide, slopes to the south of west and drains into West Twelve-Pole River. The crest of the divide is not far from 1,000 feet above the level of the sea. The following statement shows the whole number of large timber trees now growing on this tract of 655 acres, by kinds and exposures. This tract was found to have growing on it, 16,989 trees; an average of about 26 large timber trees to the acre.

Kinds of Trees.	Western Slope.	Eastern Slope.	Trees of Each Kind.
White oaks	1,256	730	1,986
Chestnut oaks	3,806	2,083	5,886
Black oaks	734	366	1,100
Red oaks	494	242	736
Hickories	1,556	991	2,547
Chestnuts	1,203	697	1,900
Locusts	148	59	207
Maples	224	106	330
Birches	159	174	333
Tulip-poplars	386	472	858
Pines	563	376	939
Lindens	93	74	167
Totals	10,619	6,370	16,989

The proportionate percentage of the hardwood trees of the above table, all those named except the tulip-poplars, pines, and lindens, is quite remarkable. The softwood trees are: 1,042 on the westward slope and 922 on the eastward slope, a total of 1,964, or less than ten per cent of the whole number of trees on the western slope, over fourteen per cent of those on the eastern slope, and nearly twelve per cent of the whole number of trees, leaving over ninety per cent of the westward slope trees and near eighty-six per cent of the eastward slope ones as hardwoods. So these hardwood trees constitute eighty-nine per cent of all the large counted and measured trees now growing on this tract of land. The figures of the table indicate that the large hardwood trees are more abundant on the westward exposure of the dividing ridge.

The record of the diameter and length of each of the trees embraced in the above list, that now lies before me, shows that most of these trees are of large size, the oaks ranging in diameter from eighteen to sixty inches, and in trunk length from twenty to sixty feet. The hickories range from ten to twenty-seven inches in diameter, and from fifteen to sixty feet in trunk length; the pines from eighteen to forty inches in diameter, and twenty to seventy feet in trunk length; and the tulip-poplars from twenty to sixty-six inches in diameter, and from thirty to eighty feet in trunk length.

JED. HOTCHKISS.

Staunton, Va.

THE SPECIALIST.[1]

"MANY scientific men of excellent reputation are to-day guilty of the crime of unnecessary and often premeditated and deliberately planned mystification; in fact, almost by common consent this fault is overlooked in men of distinguished ability, if, indeed, it does not add a lustre to the brilliancy of their attainments. It is usually regarded as a

[1] A few thoughts suggested by the address of the retiring president of the American Association for the Advancement of Science, delivered at the Indianapolis meeting, August, 1890, from which the quotations here given are taken.

high compliment to say of A, that when he read his paper in the mathematical section no one present was able to understand what it was about; or of B and his book, that there are only three men in the world who can read it." . . . "There is a strange and unwholesome prejudice against making science intelligible, for fear that science may become popular." . . . "There is an unfortunate and perhaps a growing tendency among scientific men to despise the useful and the practical in science, and it finds expression in the by no means uncommon feeling of offended dignity when an innocent layman asks what is the use of some new discovery."

The progress of science during the last half-century has been especially remarkable. We are enjoying the product of the mental endeavor of all the past; one forward step has been followed by another, until, in scientific attainments, we are far in advance of the broadest views held a century ago. The age of the earth, its motion and gravitation no longer cause excited controversies. The existence of fossils now occasions no alarm; whether found upon the mountain-top or in the depths of the sea, the explanation is equally satisfactory.

Geology, like the fabled giants of old, has taken wonderful strides; has stepped off, as it were, a thousand years at a pace, and the sermons inscribed on nature's tablets have quickened the understanding and broadened human conceptions. Our knowledge of astronomy and geology has enabled us to cast out the coiled serpent of superstition, and given us truth in its stead. Can the most fertile imagination conceive of loftier heights than chemistry has reached when it is able to measure the five-millionth part of a grain of our far distant sun?

The use of anæsthetics is almost entirely a growth of the last fifty years; like a beneficent angel, conquering pain, annihilating as with magic breath the sufferings of thousands of human beings. Witness now the electric light, and think in comparison of the feeble glimmer of tallow candles. Not many years ago even the lonely light-house tower afforded nothing better than tallow candles to guide the traveller on the storm-tossed sea. Until recently electricity has been like a wild ungovernable force, but skilful hands are bringing it more and more under subjection. It is taking the place of brawn and muscle. The courier is no longer needed to despatch our messages on land or by sea. Here and there it has been harnessed to the street railway, and its practical applications are numberless.

It is but a few years since we have had any definite knowledge of bacteria, but who now is not familiar with at least the depredations of these insidious foes? Foes we may well call them when it is estimated that four-fifths of all diseases of humanity are caused by these pathogenic microbes, and that they destroy more lives than war or famine, fire or shipwreck.

Who has enabled science, this second Hercules, to open nature's doors and bring forth her treasures? Who is it that has gleaned her truths and read her laws, but he who has made a special study of them? There is not a practical application of a force of nature and scarcely a material substance that we use which has not resulted from the experimental researches of specialists. Is it not the geologist who has told us the story of the earth? Is it not the chemist who analyzes the sun, the biologist who unfolds for us the life histories of our invisible foes?

It is obvious that a geologist must have worked in geology, that a botanist must have done special work in botany; and in order to have taken up special work they must necessarily have done elementary work. There must be a foundation laid before the super-structure of special work can be reared. There is no royal road to knowledge, and there is no short cut to special work. The disciplinary work which leads up to special work must be done by each individual for himself; skill in manipulation cannot be acquired at second-hand, and judgment is gained through experience alone. The specialist does not simply devote a few years to his chosen work and imagine his investigations cease when he takes his Ph.D.; not at all; the devotion of a lifetime is bestowed on his speciality, which broadens out before him, luring him on with the mysterious charm of unexplored labyrinths. The work of the specialist is to investigate, to find out the truth. He must divest himself of all prejudice, and with unbiased mind "read from the manuscripts of God" the truths there written, whether found on the granite rock or in the story of embryonic life.

In the simplest forms of life there is no specialization of organs. Take, for example, the amœba, which is but a tiny speck of protoplasm — an undifferentiated mass; having no organs of locomotion, no mouth, no stomach, it yet moves about, finds its own food, appropriates and digests it. How does it accomplish these complex operations? It moves by pushing out a tiny slimy thread of protoplasm, and the whole mass flowing after it; when it comes in contact with an object which will serve it as food, it flows over it, wraps itself around it, absorbs the nutritious parts, and flows away from the *débris*. Thus this little animal is at times all legs, again all mouth, and still again all stomach, but possesses no differentiated specialized organs This we call the lowest type of animal life; the higher we ascend, the greater the specialization, reaching its culmination in man. The stomach prepares the food, the blood distributes it, the lungs take charge of ventilation, the liver looks to sanitation; the heart is general manager, and the brain, if you please, cultivates "social science." It is plain to everyone that the work done by the amœba is extremely rudimentary compared with that accomplished by man. The amœba fulfils the two essential purposes of life, maintenance and reproduction; mankind does the same, but who can measure the difference in degree?

Is not the work of the general student and that of the specialist in a measure comparable to that of the lowest and highest types of life? The general student who claims an equal familiarity with all branches of knowledge possesses but the rudiments of each. And mark the interdependence of the most specialized organs! No one of them can carry on the work alone; and it is thus with the sciences, advancement in any one of them means general advancement of the whole commonwealth.

All organic life is built up of cells; take any herb, shrub or tree; its tissues are made up of individual cells: each cell is filled with protoplasm, and though the cell walls are apparently continuous, having no visible openings even under high powers of the microscope, it has nevertheless been found that infinitesmal streams of protoplasm extend from cell to cell, connecting the entire plant as with a sympathetic nerve into one continuous whole. And so there is an invisible cord which binds all nature into one harmonious unity. There is a kinship, a brotherhood, a great sympathetic nerve which runs through all branches of natural science. To the general student they may appear independent of each other, but the specialist digs down beneath the surface where the roots are found ramifying in all directions; meeting, overlaping, interlocking with each other.

What can the specialist in physiology do without some knowledge of physics and chemistry? Geology, zoology and botany are hedged with problems whose solution are interdependent. If the sciences are united as with a network, a specialist in any one of them must have some knowledge of those which claim near kinship with his own.

But the specialist is accused of couching his discoveries in language which is unintelligible, of being unpractical; of trying as it were to hide his light under a bushel. Are these accusations well-founded? Are they true? Is it reasonable to suppose that one who studies in nature's laboratories a lifetime should think it desirable to erect a wall about science lest it become popular? Are not specialists numbered among the world's great leaders? To whom is due the great advancement in medical science but to specialists, who in their laboratories patiently sought for answers to problems of whose importance the common mind has no conception? A few years ago a war of words waged high over the theory of spontaneous generation; who but the specialist was able to settle forever this formidable question. Did the world imagine for one moment that the investigations which resulted in the establishment of the "germ theory" would lead to practical results? Physicians, surgeons and boards of health but apply the principles elucidated by the specialist. Enter a laboratory and behold a specialist in the midst of his bacteriological investigations. Would the observation be likely to call forth predictions of practical results? You would see "cultures" under bell-jars, microscopes, and various apparatus; "but," you exclaim, "what bearing do they have on human welfare?" Under the supervision of the bacteriologist they touch the very heart of humanity, bidding it look to its drains and sewers, to its drinking water, to the air it breathes and the purity of its food. Our knowledge of disinfection comes from the same source; who can measure the practical results? Practical applications of investigations in *fungi* reach out to the horticulturist and the farmer, who anxiously look to the specialist for remedies against their microscopic enemies. When the results of the investigations of specialists radiate like the rays of the sun to all humanity, offering balm for its wounds, remedies for its ills, shall they themselves be deemed unpractical, having no concern for human welfare? When they stand face to face with nature and read the histories she has written on shell and stone, on land and sea; when they recognize the bond of union in the division of labor, shall they be charged with "deliberately planned mystification" of the truths they would gladly sow broadcast over the land? Specialization is a law of nature which is stamped on every blade of grass, and on every flower that blooms. Heredity emphasizes this law in every phase and form of life. If it were not so, no individuality would exist. The oak tree does not take upon itself the production of roses, apples or grapes, nor does the rose ever dream of producing acorns or of elaborating material which will ultimately form an oak tree. Each individual cell in every plant contributes to the building up of its own special tissue.

Suppose we take the musical notes of some grand symphony, and scatter them at random on the musical staff; rendition would create but jarring discords. Let a Mozart or a Beethoven place each note where it belongs, and the resulting harmony "wakens in the soul a feeling earthly speech can ne'er declare." May not mankind be compared to these musical notes, creating discord in society because the individuals are not so placed as to enable them to gratify their best and highest aspirations, to do their special work? Is it utopian to hope that each individual, like each note in a musical conception, may some day swell the grand choral of the universe?

MRS. W. A. KELLERMAN.
Columbus, O.

ON A RECENT DISCOVERY OF THE REMAINS OF EXTINCT BIRDS IN NEW ZEALAND.[1]

A DEPOSIT of moa bones, larger than has been found for many years, has just been discovered near the town of Oamaru, in the province of Otago, in the South Island of this colony. Their presence was indicated by the disinterring of a bone during the ploughing of a field, by the proprietor of which the circumstance was communicated to Dr. H. de Lautour of Oamaru. This gentleman, who is well known through his papers on the diatomaceous deposits discovered by him in his district, at once inspected the spot. Finding that the deposit was large, he first secured, through the kindness of the proprietor, the inviolability of the ground, and then telegraphed the information to the Canterbury Museum. I lost no time in proceeding to Oamaru with one of my assistants, and superintended the digging out of the bones in a systematic manner. The site of the deposit was at Enfield, some ten miles to the north-west of the town, on ground elevated several hundred feet above the level of the sea, in a shallow bayleted hollow, into which the unbroken surface of the expansive slope gently descending from the Kurow hills to the open vale of the Waireka (a stream that rises further to the west) has sunk here for some seven to eight feet below the general level, and which, proceeding with a gentle gradient valleywards, becomes a ditch-like conduit for a tributary of the Waireka. In the centre of this depression, which does not exceed ten or twelve yards in width, the ground was of a dark brown color, damp and peaty. On removing the upper layer of soil for a depth of three to four inches round where the bones had first been brought to the surface, and whereon was strewn abundance of small crop-stones, a bed of very solid peat was reached, and firmly imbedded in it were seen the extremities of numerous Dinornis bones, most of them in excellent preservation, though dyed almost black. Further digging showed that certainly many of the skeletons were complete, and had been but slightly, if at all, disturbed since the birds had decayed. Owing, however, to the close manner in which they were packed together, and especially in which the limbs were intertwined, it was rarely possible to extricate the bones in the order of their relations, or to identify with certainty the various bones of the same skeleton, each bone having to be extracted as the circumstances of the moment directed. In many cases, again, only the pelvis and femora could be traced *in situ*, the vertebræ and remaining leg-bones being indistinguishable in the general agglomeration. It seemed evident that the birds had not died in an erect posture, but more probably with their limbs bent under them or in the same plane with the body. In some instances, beneath the sternum were found, lying quite undisturbed, the contents of the stomach, consisting of more or less triturated grass mingled with crop-stones. The quantity of these smooth, rounded (chiefly white quartz) pebbles — in size from that of a bean to that of a plum — mingled with the bones was enormous, and would, if collected, have formed more than a cart-load. Except where the bones were, there were no pebbles of any sort, no small stones, nor even sand, anywhere around. The nearest place where pebbles of the same composition are to be found is, I was informed, several miles distant.

[1] From Nature.

Four trenches, or pits, in all, were sunk. The dimensions of the first, which was excavated entirely in peat, did not exceed three feet square and three and a half to four feet in depth. When it was exhausted of its treasure, a second search was made about twenty to twenty-five feet higher up the hollow. The dimensions of this pit extended to about seven feet square and to the same depth as the first. Two more trenches, a few feet part, were dug at about thirty yards still further up the depression. They were not so large as the other two, but they extended down to about the same depth, three and a half to four feet, the bottom of both being (as it was in the second) a bluish clay, with which, in the pit furthest up, was sparingly mingled a small deposit of the finest silt. In the first pit portions of both Cnemiornis and Hæpagornis bones were found in abundance, and remains of several hundreds of moas of all ages. It was from the second pit, however, that the largest deposit of moa bones was obtained, and the most perfect specimen of food remains from beneath a sternum. Here, also, numerous bones of the giant buzzard and of the great extinct goose were exhumed, and a cranium as large as, if not slightly larger than, that of Cnemiornis, but of a species with complete bony orbits, as in the Cape Barren goose, and indistinguishable from Cereopsis. Bones from other parts of New Zealand now in my possession, which I hope shortly to describe, indicate with certainty that several species of Cnemiornis formerly existed in this colony. Some of these bones are remarkable for their slender elegance, and indicate species less in size and lighter in build than Cnemiornis calcitrans. Among the bones so far examined, I have observed no remains of Aptornis, of Ocydromus, or of Notornis; but I possess an adult tibia of a rail smaller than Porphyrio melanotus, yet larger than any other existing New Zealand species. The tarso-metatarsus of a species of Anas, about the size of Anas finschi, the metatarsus and sternum of Apteryx Oweni, and crania of A. australis, are among the bones recovered at Enfield, in addition to the metatarsus of a Biziura, somewhat larger than Biziura lobata, the musk duck of Australia, an interesting species for which I have proposed the name of Biziura de Lautouri, after the gentleman to whom I am indebted for the acquisition of these bones. There are still other bones which I have not yet been able to identify. The Dinornis remains belong chiefly to the species elephantopus (of unusually large proportions), to ingens, and to rheides. Very fine specimens of pelves and sterna have been obtained, with numerous crania more or less perfect. In this second trench the excavation penetrated through the peat into a bluish clay charged with water (which was, indeed, reached in all the diggings at about four feet below the surface), and into this clay the bones just protruded, but no more. The osseous remains dug from the last two holes belonged to the same species as those from the others. Digging and probing the ground beyond the boundaries of the trenches showed us that we had exhausted their contents; while the probing of the ground in the neighborhood for a considerable radius around, and in other peaty spots not far off, failed to afford indications of other deposits.

The number of perfect femora of Dinornis brought away exceeded 600; a large number were so decomposed as to fall to pieces in the handling; while a great many others disintegrated, after removal from the ground, on exposure to the atmosphere. I believe I do not over-estimate, therefore, in saying that from 800 to 900 moas at least were entombed in this shallow hollow. So many moas (leaving out of the reckoning the other species of birds) could not by any possibility have found standing-room, however crowded together, in the entire area of the depression. It would appear evident, therefore, that they did not perish all at one time. To account for their burial in such numbers in areas so circumscribed seems to me at present impossible. That their bodies were entire when they were deposited is clear, from the presence in such abundance of the crop-stones, from the position of the bones, and from the finding of the intact contents of the gizzard. No stream of any size could find origin in the immediate neighborhood, and no stream which could have transported the entire carcasses of birds of such huge proportions as Dinornis ingens or D. elephantopus could ever have occupied this ravine-head without leaving traces of its action on the surface which would be visible to-day, or without washing away the very fine silt mixed with the clay on which the bones lie, in the bottom of the most upland of our excavations. None of the bones are waterworn. This little hollow was, in the early days of its present proprietor, very wet and boggy, and several springs have origin in it. If the moas made this a highway from one part of the country to another, it seems difficult to believe that birds so powerful of limb, and standing at least 10 to 12 feet in height, could stick fast in so shallow a bog; and to conjecture why eagles of powerful flight, slender rails, small ducks, and comparatively light-footed kiwis also should become ensnared. Driven by fire in the surrounding bush — which may have covered the country then, for the plough has, I am informed, brought to light the stools of many large trees at no great distance, while logs of wood were found among the bones — did they, in a struggle for life in a narrow space, trample each other to death? The presence of the strong-winged Harpagornis in considerable numbers seems to militate against this explanation, and no calcined bones have been discovered. An explanation offered some years ago, to account for the presence of a great number of moa and other bird bones in a somewhat similar situation in the Hamilton swamp — that during severe winters these birds congregated at the springs rising warmer from below, and were overtaken by a severe and fatal frost as they stood in the water — appears unsatisfactory in the present case, as there are numerous springs and equally boggy ground near at hand, round which no remains can be found, and so close to the sea such excessive frosts are now unknown. That these were individuals who, during an excessive drought, arrived at the springs too far exhausted to revive — an occurrence common enough in Australia — and that the water there was charged with poison, have also been offered as explanations. But the permanence of glacier rivers, highest in the hottest seasons, precludes the idea of animals dying of thirst in this island, or at all events in this locality so near to the great snow river Waitaki. Poisoned water-holes or exhalations of carbonic acid might be a sufficient reason, yet in those springs elsewhere where bones have been found chemical analysis has failed to detect any substance harmful to life in their waters at the present day. Not a single indication of human intervention was observed. No bones were discovered which had been broken in their recent state; neither kitchen-middens, nor remains of ovens or of native encampments, occur anywhere near the deposit.

One piece of egg-shell dug out of the highest trench is not sufficient evidence on which to base the supposition that the spot was frequented as a nesting-place.

At Glenmark, in the north of this province, the historic spot where the original (somewhat larger than the present) find of Dinornis reliquiæ was dug out by my predecessor,

the late Sir Julius von Haast, the bones of numerous species of birds besides moas were found. Their occurrence in the situations where they were discovered, and the way in which they were lying — entire bodies with their sterna covering crop-stones *in situ* — have been explained by the supposition that the moas were overtaken by a fierce and sudden storm, and their entire carcasses piled by wind and flood into vast heaps, an explanation against which the presence here also of the same powerful buzzard and other flying birds rises as an objection. Yet there is nothing either in the situation or the disposition of the bones to make it impossible; still I cannot help feeling that that cannot be the true explanation which satisfies only one instance out of so many assemblages of dead birds of nearly always the same species in situations almost similar. I hope, however, that when I have made a thorough examination of all the localities where, and the conditions under which, moa remains have been found, in the light of the personal experience gained in the exhumation of the present deposit, and when I have completed the identification (on which I am now engaged) of the smaller bird bones associated in them with the moa bones, some light may have been gained on this at present mysterious episode in the history of the ancient Avians of New Zealand.

HENRY O. FORBES.

Christchurch, New Zealand.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

Need of Physiology and Anatomy in Psychological Training.

IN a recent article in *Science*, by Dr. E. W. Scripture of Clark University, some valuable and practical ideas are advanced concerning "the need of psychological training," in which the necessity of a practical knowledge of physics is made clear. But no less necessary is a like knowledge of physiology and anatomy.

Physiological psychology is no misnomer for modern psychology, because it is as much if not more physiological than psychological. That, consequently, a somewhat extensive knowledge of physiology is a *sine qua non* for the thoroughly trained modern psychologist goes without saying; and this is as true whether there be sympathy or not with the modern view, for, in the latter case, the psychologist can hardly avoid discussing some of the results of physiology; and such discussions, to be trustworthy and valuable, must be based upon knowledge. And here is not meant mere book knowledge, but experimental knowledge gained in the physiological laboratory, otherwise when one speaks of sensations, reflex action, afferent and efferent nerves, etc., it is difficult to understand how he can have any adequate insight into the objective reality of these phenomena. It is not intended that any large amount of time be required for purely physiological laboratory work. A term's course, say of six hours a week, might be the minimum; in this case it is assumed that the student has a general knowledge of human and comparative physiology.

If the above requirements are necessary for one who proposes to study physio-psychological questions, it may be inquired further as to anatomical knowledge. That a proper conception of physiology is not possible without anatomy is so obvious as to be commonplace, and yet there are some who are serious students of physiological psychology who have no practical knowledge of anatomy. A general dissection of the body and special dissection of the sense-organs and brain, while it would require more time than the physiological course, would be well worth the extra trouble, since it is preliminary foundation-work, and is also necessary for the investigation of pathological clinical cases, some of which are of the highest importance for the physiological psychologist. For this and other reasons an elementary course in practical histology is necessary. Thus it is not clear how any student without practical knowledge of coarser and finer anatomy can study and discuss intelligently questions concerning cerebral localization, cranial and spinal nerves, spinal column, medulla oblongata, etc.

It may be objected that many of the facts learned in such a course of study would not be of direct utility, but this could be urged against almost any course of study. The value of such negative knowledge consists in serving as a sort of ballast in aiding the student in avoiding mistakes.

It may be said that if practical courses in anatomy and histology are requisites, why not also similar courses in pathology and psychiatry. It is true that these would be valuable; but there must be a limit; perhaps the student could take up individual pathological cases as they came in the course of his work, provided he has the physiological and anatomical knowledge of normal man before mentioned. It is assumed that the specialist in physiological psychology will read the writings of specialists in physiology, anatomy, and pathology when they treat of topics that bear directly on his own studies. To read such literature, appreciate the points of discussion, and make decisions as to weight of evidence, requires at least a practical elementary knowledge of the subjects.

But it may be objected that, with accurate book learning and good diagrams, one can gain sufficient insight without going to the trouble of taking the practical courses. This objection is more real practically than rationally, for many do not care for vivisection, and much less dissection. It is a well-known difficulty, common to medical schools, to obtain faithfulness in dissection. There seems to be a natural disinclination, not of the nature of dread or disgust that may appear on first entering the dissecting room, but quite another feeling, that is easier experienced than described. The physiological psychologist who has had no medical training is very liable to have a strong disinclination to practical work in anatomy, even if he believes in its utility and necessity. Then there is sometimes the feeling that it is so much easier and saves time to sit quietly in one's own room and study the books and diagrams.

It may be said that some good workers in physiological psychology have never had this preliminary training, but this is rather in spite of such training, As is well-known, many students of philosophy, having become dissatisfied with its methods and results, have turned their attention to experimental psychology, and have neither time nor opportunity to return to preliminary work, which they could have done had they known beforehand the subsequent direction of their studies.

The fact that the majority of leaders in the department of physiological psychology were previously physicians or students of medicine indicates the direction which the training in physiological psychology should take.

A. MACDONALD.

Washington, D.C.

Anthropology.

THE science of anthropology has so far progressed that it is desirable to keep a satisfactory account not only of its operations but of its resources. Under this head should be included: 1. Encyclopædic works, general treatises, annual addresses, courses of lectures, dictionaries, general discussions, and classifications of the science as a whole. 2. Societies, their organization, scope, history, enterprises, and publications, as well as annual assemblies, caucuses, congresses, national and international. 3. Periodicals, devoted as a whole or in part to anthropology. 4. Museums and laboratories, public and private, expositions and loan exhibitions. 5. Libraries, galleries, portfolios, etc., including instructions to collectors.

At this time it is desirable to know what is doing in each State along the line of anthropology. We all know pretty well the work doing in Massachusetts; but where should we look for the

archæological and anthropological resources of Maine, New Jersey, Kentucky, Oregon, etc. There are in all the States societies of natural history, and it would be pleasant to know whether they discuss anthropological topics. Many private collections of great value are to be found in the States; who knows about them? Now I shall be delighted to have the following questions answered with reference to every State in the Union: 1. Name of society, publication, or collection, public or private, devoted to the whole or a part of anthropology. 2. The nature of this relation to the science with lists of printed books or references in print to these. 3. The name and address of the person who will be glad to give information.

O. T. MASON.

Smithsonian Institution, Washington, D.C., Mar. 11.

The Aboriginal American Tea.

COMMENTING on my recent query as to any recent use of *Ceanothus Americanus* as a substitute for China tea, Professor W. J. McGee of the United States Geological Survey writes me: —

"Your little note in a current number of *Science* on aboriginal tea is before me. The eastern portion of the Great Plains, including Iowa, Illinois, and parts at least of Missouri, Minnesota, and Wisconsin, is a favorite habitat of the so-called "red root" or "red-root tea" (Ceanothus Americanus); and during war times, when the prices of tea and coffee were prohibitory, so far at least as first settlers in that country were concerned, many substitutes were employed. The common substitute for tea was the red-root, and it was very largely used in this way. The commonest substitute for coffee was rye, usually mixed with a small quantity of the coffee berry, both roasted and browned in the usual way. I should say, perhaps, that the identification of *Ceanothus Americanus* is partly my own and may possibly be erroneous."

I hope we may have other such interesting and valuable replies.

JED. HOTCHKISS.

Staunton, Va.

The Date of Discovery of the Galapagos Islands.

I AM indebted to Dr. H. Wichmann, the editor of *Petermann's Mitteilungen*, for an answer to my question in *Science* of Jan. 15, 1892: "At what time were the Galápagos Islands discovered?" Dr. H. Wichmann kindly calls my attention to a paper on the history of discovery of the Galápagos Islands, by Timénez de la Espada, published in *Boletin de la Sociedad Geogr. de Madrid*, Oct.–Dec., 1891., XXXI., Nos. 4–6. From this it is evident. Dr. Wichmann writes, that the discovery of the islands, "Archipélago Encantado," was made the 10th of March, 1535, by Fray Tomás de Berlanga, Bishop of Castilla del Oro, whose report is printed in the paper.

G. BAUR.

Clark University, Worcester, Mass., Mar. 14.

CALENDAR OF SOCIETIES.

Philosophical Society, Washington.

Mar. 12. — B. Pickman Mann, An Attempted Solution of a Social Problem; Alex. S Christie, Remarks on the Diurnal Variation of the Barometer; G. M. Searle, On a Simple Form of a Double Image Micrometer.

Society of Natural History, Boston.

Mar. 16. — J. Walter Fewkes, The Moki Snake Dance.

Oriental Club, Philadelphia.

Mar. 17.—Cyrus Adler, An Account of his Recent Travels in the East.

Publications received at Editor's Office.

COLBERT, E. Humanity in its Origin and Early Growth. Chicago, Open Court Pub. Co. 12°. 409 p. $1.50.

HOOGEWERFF, J. A. Magnetic Observations at the U. S. Naval Observatory. Washington, Government. 4°. Paper. 99 p.

MARSH, C. C. Report upon some of the Magnetic Observatories of Europe. Washington, Government. 4°. Paper. 87 p.

U. S. NAVAL OBSERVATORY. Meteorological Observations and Results, 1888-1887. Washington, Government. 4°. Paper. 261 p.

U. S. COAST AND GEODETIC SURVEY. Results of Magnetic Observations at Los Angeles, California, 1882-1889. Part 1. Washington, Government. 4°. Paper. 42 p.

——Early Expeditions to the Region of Bering Sea and Strait. Washington, Government. 4°. Paper. 14 p.

——International Geodetic Association, Ninth Conference. Washington, Government. 4°. Paper. 12 p.

——Notes on an Early Chart of Long Island Sound. Washington, Government. 4°. Paper. 4 p.

——On an Approximate Method of Computing Probable Error. On the Determination by Least Squares of the Relation between two Variables. Washington, Government. 4°. Paper. 16 p.

——On the Use of Observations of Currents for Prediction Purposes. Washington, Government. 4°. Paper. 12 p.

——The National Phototypes of the Standard Metre and Kilogramme. Washington, Government. 4°. Paper. 23 p.

——The Relation of the Yard to the Metre. Washington, Government. 4°. Paper. 5 p.

——Tides at Sandy Hook. Observed and Predicted Times and Heights during the year 1889. Washington, Government. 4°. Paper. 10 p.

WHYMPER, EDWARD. Travels amongst the Great Andes of the Equator; with Supplementary Appendix. New York; Charles Scribner's Sons. 8°. 2 vols. Pp. 486, 175.

BOOK-REVIEWS.

A Manual of the Steam-Engine. Part II: Design, Construction, and Operation. By R. H. THURSTON. New York, Wiley. 8°. $7.50.

THE first part of the "Manual of the Steam-Engine" we have already noticed. Its purpose was twofold: (1) the development of the mathematical theory from the simple form applicable to the Carnot engine to a form that would assist the mechanical engineer in following the flow of energy into the engine of practice and its conversion into power or loss in many ways; (2) the application of the principles of thermo-dynamics and the data obtained by experiment to the computation of the quantities of heat, steam, and fuel required for the production of power in a given engine, and the determination of the proportions of engine and distribution of steam that would give the best result.

But so much has been gained by experience, simply, in the design and construction of engines, aside from the progress based on theoretical considerations alone, that the author has preferred Part II. of his Manual to cover the more usual methods of design, construction, and operation of the steam-engine. Part I. contains the scholastic foundation; Part II., the practitioner's super-structure.

The two volumes already issued, it is proposed by the author, are to be followed by a third, which shall contain working drawings of the latest and best modern machinery of this class. The third part will, therefore, provide an atlas of such drawings, with concise accompanying text.

After treating the portions of his subject which are recognized as belonging to mechanical engineering, our author, in the last chapter, treats of the financial element in the theory and practice of steam-engine construction. This is something quite novel, and Professor Thurston looks to his friends for such criticism as will lead to the further development of this branch of the subject. Designing for a minimum cost is a matter which every experienced member of the profession has constantly been compelled to consider; but scientific methods of computation of minima rarely have been known or practised.

SCIENCE

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

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SCIENCE

NEW YORK, MARCH 25, 1892.

THE PUMA, OR AMERICAN LION.[1]

THE puma is the only large, unspotted, native American cat. The general color of the fur is tawny, but on the under surfaces of the body it is whitish. The color of the central line of the back is darker than that of the sides and the end of the tail is dusky brown. The ears are black externally, with a central whitish area. The upper lip is white from the nostrils to the middle of the mouth, and at the latter point is a prominent black spot. The nostrils are flesh-colored. Baird compares the color of the puma to that of the Virginia deer, and states that it varies with the seasons as it does in the deer; that is, the summer coat is reddish and the winter coat grayish.

There is much variation in color among individuals of this species, but it has not been proven that this is correlated with the varying climatic conditions of its range. The occurrence of albino pumas in the Alleghany Mountains and in New Mexico has been reported, but not authoritatively.

Burmeister remarks on this point: "Very rarely individuals of this species of a brown, nearly black color have been found, while differences in color between yellowish-brown and yellowish-gray are not rare. I am aware that individuals nearly white and others nearly black have been observed, but I have never seen such myself."

New-born pumas are very different in appearance from the adults. Instead of being of uniform color, the back and legs are covered with large blackish-brown spots, and the tail is ringed with the same color. According to Dr. W. A. Conklin these markings disappear in about six months after birth.

The male puma in the National Museum is of the following dimensions: Head and body, measured along the curves, 53 inches; tail, 26½ inches; height at the shoulder, 22½ inches. Audubon and Bachman give the following dimensions of a male killed by J. W. Audubon at Castroville, Tex., Jan. 28, 1846. From point of nose to root of tail (whether measured along curves, not stated), 5 feet 1 inch; tail, 3 feet 1 inch; height of ear posteriorly, 3 inches.

The male puma measured by Azara was somewhat smaller, the head and body being 51⅛ inches and the tail 29 inches. The system of measurement is not given.

The average dimensions obtained from these three individuals are: For the head and body, 55$\frac{1}{24}$ inches, and for the tail, 30⅛ inches; total, 85 inches.

I have found no authentic record of any individuals measured before skinning of which the dimensions were greater than those of Audubon's specimen mentioned above. The total length in that case was 8 feet 2 inches. There are, however, records of measurements of flat skins of greater size. I have myself measured a skin from Colorado in the National Museum, No. 19,906, of which the total length in a straight line is 8 feet 4 inches. Mr. Livingston Stone states that the skin of a puma killed on the McCloud River, California, "measured 8½ feet when stretched." The average total length of nine flat skins of adults in the possession of Mr. F. S. Webster of Washington is 7 feet 4 inches.

The area over which the Puma ranges extends from New England and British Columbia to the Straits of Magellan. On the Atlantic coast of North America the species has apparently not been found in the States of New Hampshire, Rhode Island, New Jersey, or Delaware. On our northern boundary I find no mention of its having been found in Michigan or Indiana. In Ohio it was extirpated prior to 1838, and probably more recently in Illinois and Indiana. I find no record of its occurrence in Nevada, but as it has been found in the surrounding States it seems improbable that it should be entirely absent there.

With these exceptions there are recorded instances, more or less numerous, of the occurrence of the puma in every State and Territory of the Union, dating from the beginning of the century. Like many other large American animals, however, the puma has retired before the advance of civilization, and in many of the more thickly populated States it is improbable that even stragglers could be found at the present day.

The puma occurs throughout Central America and in all parts of South America to the Straits of Magellan.

The first mention of the puma appears to be the remark in the letter of Columbus regarding his fourth voyage in 1502. In the narrative of his exploration of the coast of Honduras and Nicaragua he writes: "I saw some very large fowls, the feathers of which resemble wool, lions [*leones*], stags, fallow-deer, and birds."

There are also references to the occurrence of the puma in North America of very early date in the narratives of Laudonnière, Hariot, Coronado, Hawkins, and others.

The puma, regarded as a species, possesses in a remarkable degree the power of adapting himself to varied surroundings. He endures severe cold in the winter in the Adirondack Mountains and other parts of our northern frontier, and tracks his prey in the snow. He is equally at home in the hot swamps and canebrakes along the river-courses of our southern States. In South America he inhabits the treeless, grass-covered pampas as well as the forests. In the Rocky Mountains, as I am informed by Mr. William T. Hornaday, he ascends to the high altitudes in which the mountain sheep are found. Mr. Livingston Stone saw tracks of the puma on the summit of Mount Persephone in California, at an elevation of 3,000 feet. Similarly, Darwin states that he saw the footprints of the puma on the cordillera of central Chili, at an elevation of at least 10,000 feet. According to Tschudi, the puma is found in Peru in the highest forests and even to the snow-line (though seldom here). A writer in the "Encyclopædia Britannica" states that "in Central America it is still common in the dense forests which clothe mountain ranges as high as 8,000 or 9,000 feet above the sea-level."

In these different regions the puma always selects for his abode such spots as afford some shelter, but we find him in the thickets and copses, rather than in the great forests. "Those panthers that we have observed," writes one of the naturalists of the Mexican Boundary Survey, "were always

[1] Abstract of a paper in the latest Report of the National Museum.

found in the most solitary places, generally where there were thick bushes, and in the vicinity of rocky spots, affording caverns for secure concealment, and in which to bring forth their young."

The puma seeks his prey chiefly at dawn and twilight and under cover of night, but he also sometimes hunts by day. The different species of American deer are his principal quarry, but he preys also upon smaller mammals. He will even feed upon the different species of American porcupines, despite their quills, which lacerate his mouth and face. Audubon and Bachman state that raccoons and skunks, as well as birds, form a part of his food, and that he will eat carrion when hard pressed by hunger. To this list Brehm adds the South American coati, agouti, and paca, and the rhea, or American ostrich. Dr. Coues and Yarrow state that in New Mexico and Arizona the puma kills hundreds of wild turkeys and has indeed broken up many of the former breeding-places. Pennant asserts that the wolf serves the puma for prey. This is improbable. Nevertheless, he reports that there was in the Museum of the Royal Society of London the skin of a puma which was shot shortly after it had killed a wolf.

Of the larger domestic animals, such as the horse and cow, the puma attacks only the young, but he will carry off a full-grown sheep from the fold, and not unfrequently preys upon the llama in South America.

In the less settled portions of America the puma has proved at times a great hindrance to stock raising. Kennerly states that in Sonora, Mexico, it kills many colts and calves, and is poisoned with strychnine by the herdsmen. Mr. C. H. Townsend remarks, in 1887: "It is practically impossible to raise colts in the Shasta County hills, California, on account of these pests. They destroy many hogs and young cattle also, but do not present so serious an impediment to the keeping of these animals as in the case of horses." I have recently received similar reports from other sources.

The puma does not ordinarily attack men, but, on the contrary, when surprised attempts to flee from them. Nevertheless it seems probable that some individuals, when strongly pressed by hunger, or moved by other unusual circumstances, may be emboldened to make such attacks. Hensel affirms that such is the case. Darwin states that he had heard of two men and a woman who were killed by pumas in Chili. McMurtrie mentions that a woman was killed by a puma in Pennsylvania, January, 1830. That the puma sometimes kills the hunter who has wounded him is doubtless true, as any wounded animal is likely to turn upon its persecutor, but this is quite different from an unprovoked assault.

It is the habit of the puma to spring upon his prey from an eminence, such as a ledge of rock or a slight rise of ground. If he fails to strike his victim, he seldom pursues it for any considerable distance. In northern regions, however, he sometimes pursues the deer when they are almost helpless in the deep snow. It was reported to Darwin that the puma killed its prey by jumping upon the shoulder and turning the head back with its paw until the vertebræ of the neck are broken or dislocated. Azara ascribes the same habit to the jaguar.

The female brings forth her young in some secluded spot. In the Adirondacks, according to Dr. Merriam, "the lair is usually in a shallow cavern on the face of some inaccessible cliff or ledge of rocks." "In the Southern States," says Audubon, "where there are no caves or rocks, the lair of the cougar is generally in a very dense thicket or in a cane-brake. It is a rude sort of bed of sticks, weeds, leaves, and grasses or mosses, and where the canes arch over it, as they are evergreen, their long pointed leaves turn the rain at all seasons of the year.

From two to five young are born at a time. Bartlett states that in captivity the number is usually two, but sometimes one. Their young are reared without difficulty. They are brought forth at the close of winter or early in spring in the northern parts of the United States, and at the beginning of summer in South America, that is at the end of December. The period of gestation is from thirteen to fourteen weeks. The young first open their eyes when nine or ten days old. Their total length when born is from 10 to 12 inches. Dr. Merriam is of the opinion that in the Adirondacks the puma does not breed oftener than once in two years.

The age which the puma attains in the state of nature is unknown. It may be remarked, however, that one lived in the Zoological Garden at Frankfort, Germany, sixteen years, one month, and nine days. It died from injuries received by accident, Oct. 13, 1878. Dr. W. A. Conklin states that the various species of cats live in captivity fifteen or sixteen years, but show signs of decay at twelve years.

Authoritative writers upon the habits of the puma in North America agree that the adults do not commonly or frequently make use of trees except when traversing precipitous cliffs or when pursued by dogs. Under the latter circumstances they do not climb into a tree, but jump upon the nearest branch, even though it be at a considerable distance from the ground. Rengger, in his "Travels in Paraguay," however, states that both the puma and the ocelot climb well, and that in the forest they make their flight not only on the ground, but also by springing from tree to tree. He tells us in another place that he once saw a puma chase a troop of monkeys through the forest by jumping from bough to bough among the trees. However incredible this may at first appear, it becomes less so when we consider the wonderful denseness of the South American forests, described by Humboldt and other writers.

The puma, like the cat, has the habit of scratching the bark of trees with its claws, for the purpose of sharpening or smoothing them. Having mentioned this habit as possessed by the jaguar, Darwin writes: "Some such habit must also be common to the puma, for on the bare, hard soil of Patagonia I have frequently seen scores so deep that no other animal could have made them."

Many reliable authorities are agreed that the puma does not ordinarily emit loud cries or screams, but Kennerly, one of the naturalists of the Mexican boundary survey, states that on one or two occasions the cry of the puma was heard at a distance, and Schott writes as follows: "After dark his mournful note is heard resounding through the solitudes of the deserts. The note, listened to once attentively, is apt to make a deep, lasting impression. The different native names, as pronounced in Spanish, sound very appropriately to the note, and it is likely that the cry of the animal forms the base of its names. The note itself is often several times repeated, with intervals of from two to four minutes. As night advances the cry is heard but rarely." He also writes: "A puma was killed on the Rio Bravo, between Fort Duncan and Laredo. During his struggle with the hunters and dogs he raised a terrible cry, twice or thrice, to express his rage, and perhaps also to give his family the notice of danger." Dr. J. A. Allen reports that he once heard the puma's cry near his camp in Montgomery, Colorado. Eliot likewise states that he heard the cry of the puma at night, while camping on the St. John's River, Florida. He did not, how-

ever, see the animal, Darwin states that the puma does not often utter cries. He writes: "It is a very silent animal, uttering no cry, even when wounded, and only rarely during the breeding season."

In captivity the puma purrs when pleased, after the manner of the cat, and the female has been heard to utter a mewing sound.

The flesh of the puma is eaten by certain of the South American Indians, and was likewise eaten by the natives of North America, according to Catesby. Darwin, who tasted it himself, states that it is white in color and has the flavor of veal. Numerous other explorers and travellers make the same comment. Azara says on this point: "I have known my peons to eat it in preference to beef, even when that meat was to be had in abundance."

The puma is known under a multiplicity of English names. Among these are panther, painter, cougar, catamount, wild cat, American lion, California lion, silver lion, mountain lion, and tiger.

The word *puma* is the native Peruvian name, according to Garcilasso de la Vega, La Condamine, Tschudi, and other authors.

Cougar is an English form of the word *couguar*, which Buffon derived by abbreviation from *cuguacu ara*. This latter word, lengthened to *cuguacuarana*, is, according to Markgrave, the native Brazilian name. Azara, however, states that the ancient name, used by the Guarani Indians of Paraguay was *güazúará*. Others called it yagûá-Pitá, meaning red yagûá, or *yagûatí* meaning white yagûá.

The word "painter" is a corruption of panther. It is unfortunate that this latter name has gained general acceptance in the United States, since the true panther is a spotted, Old World cat, very different in appearance from the puma.

The name mountain lion is not altogether inappropriate, as the puma somewhat resembles the female lion in color and general form. From the earliest days the puma has been called the lion (*Leon*) by Spanish Americans and the name is still used.

The names catamount, or catamountain, and wild cat have no special applicability to the puma. They have been used by English writers to designate the European wild cat (*Felis catus*) and lynxes, and by Americans have been applied to the lynxes of this country.

Besides those names which are in common use, there are some which have been invented from time to time by various authors, and are known to zoologists as "book-names." Buffon's name *Couguar* really belongs to this class, as do also the names Brazilian cat (die brasilianische Katze of Müller), the brown tiger of Pennant, and the red tiger (*Tigre Rouge* of Barrère).

As already stated, the puma is called the lion (*Leon*) by Spanish-Americans, while the jaguar is styled the tiger (*Tigre*). Early Spanish writers, however, did not always distinguish between the two, and sometimes mentioned the puma under the name of tiger, or used the name in some modified form, as red tiger, etc. Molina states that it is called *Pagi* in Chili, and according to Clavigero, it was known to the Mexicans as *Mitzli*.

The puma is the *Felis concolor* of Linnæus. This name has been adopted by subsequent authors, almost without exception. Schreber, however, has two figures of the species in his work on mammals, one of which is styled *Felis discolor*. Molina, in 1782, gave it the name of *Felis puma*, and Lesson, that of *Felis unicolor*.

FREDERICK W. TRUE.

ASTRONOMICAL NOTES.

A New Comet.

A VERY faint comet was discovered by Denning of Bristol, England, on March 18. Its position is, R.A 22 h., 44 m., Dec. + 59°. The daily motion is north, preceding. The comet has been observed by Spetater of Vienna, and the following is his position: March 19.4338 G.M.T., R.A. 22 h., 46 m., 47.1 s, Dec. + 59°, 17′, 43″.

Winnecke's Comet.

Winnecke's periodical comet has been found and observed. The observation is from Vienna, and the following is the position: March 18.4041 G.M.T., R.A. 12 h., 43 m., 27.5 s., Dec. + 30°, 35′, 38″. It is of the twelfth magnitude.

New Planets.

A planet of the twelfth magnitude was discovered by Wolf on March 18. The following is the position: R.A. 11 h., 7 m., 20.6 s., Dec + 4°, 44′, 49″. A planet of the eleventh magnitude was discovered by Palisa on March 19. The following is the position: R.A. 13 h., 27 m., 0.0 s., Dec. + 9°, 55′, 9″.

G. A. H.

VENEZUELA AND COLOMBIA.[1]

M. CHAFFANJON, in a paper read before the Paris Society for Commercial Geography (*Bulletin*, Tome xiii., No. 4), has given a description of these countries and a narrative of the journeys he made there during the years 1889–91. Venezuela has about 750 miles of coast line. From the mouth of the Essequibo to Guiria Point, known also as Cape Peñas, opposite Trinidad, the coast is low and sandy, whereas from this point westward to the Gulf of Maracaibo it is in general high and skirted by mountains rising in some places to a considerable elevation. The chief exports of the country are coffee, cocoa, and tobacco, cattle, copper and gold. Colombia is very favorably situated, possessing about 600 miles of coast on the Atlantic and nearly as much on the Pacific. Its harbors are certainly not very accessible, but Cartagena might be converted into a safe and important port. The coasts are low and dry, or else swampy. The Sierra Nevada produces excellent coffee and cocoa, and travellers speak very hopefully of its minerals. Gold, copper, nickel, mercury and coal have been found. In the neighborhood of Lake Maracaibo and the peninsula of Coro coal is abundant, and rich springs of petroleum exist. At a distance from the coast the country consists of immense savannahs, on which grow here and there, like oases in the desert, clumps of the palms known in this part of America as *moriches*, which send down their roots perpendicularly into the soil, and by capillary action draw up the water to the surface, making the ground around them muddy and even dangerous. If from any cause these trees disappear, the soil soon becomes extremely arid. Large fortunes are made by cattle grazing, and the cultivation of sugar is also an important industry, herdsmen eating as much as three or four pounds daily of a kind of loaf made of sugar. On the high plateaus wheat, oats, maize, and potatoes are grown. Caoutchouc and resins of various kinds may be collected in the forests.

[1] From the Scottish Geographical Magazine.

NOTES AND NEWS.

THE laboratory of experimental psychology of Columbia College is established in four rooms, occupying the upper floor of the president's house. These include rooms for instruction and research, and a dark room for the study of vision. A collection of apparatus has been secured at a cost of about $2,500, and this will be further increased during the present year. The liberal regulation recently adopted by the trustees makes it possible for men of science not connected with the college to use the laboratory and apparatus for special research.

— Mr. George W. Field of Johns Hopkins University has been appointed to the American table at the International Zoological Station at Naples for three months, beginning Sept. 1. The table is at present occupied by Professor Wilson of Columbia University. The Americans at the station in 1891 were Dr. C. W. Stiles, Mr. W. L. Russell, and Miss Julia Platt.

— Steps have been taken towards the organization of Alumni Associations of Johns Hopkins University in the North-west and on the Pacific Slope. Preliminary meetings were held on Feb. 22, at Madison, Wis., where nine graduates and fellows of the university, members of the faculty of the University of Wisconsin, were assembled, and at Berkeley, Cal., where eleven persons met. The graduates meeting at Madison were: C. H. Haskins (Ph.D., 1890), assistant professor of history; G. L. Hendrickson (A.B., 1887), professor of Latin; H. W. Hillyer (Ph.D., 1885), assistant professor of organic chemistry; W. H. Hobbs (Ph.D., 1888), assistant professor of mineralogy and metallurgy; C. F. Hodge (Ph.D., 1889), instructor in biology; J. Jastrow (Ph.D., 1886), professor of experimental psychology; H. B. Loomis (Ph.D., 1890), instructor in physics; F. J. Turner (Ph.D., 1890), professor in history; C. A. Van Velzer (fellow, 1878–81), professor of mathematics. The graduates meeting at Berkeley were: Henry Crew (Ph.D., 1887), Lick Observatory; F. G. Hubbard (Ph.D., 1887), instructor in English, University of California; A. C. Lawson (Ph.D., 1888), assistant professor of mineralogy and geology, University of California; F. Lengfeld (Ph.D., 1888), instructor in chemistry, University of California; W. H. Miller (A.B., 1888), instructor in mathematics, Leland Stanford, Jr. University; E. M. Pease (fellow, 1884–85), professor of Latin, Leland Stanford Jr. University; G. M. Richardson (Ph.D., 1890), assistant professor of chemistry, Leland Stanford, Jr. University; C. H. Shinn (A.B., 1884), Niles, Cal.; M. D. Stein (A.B., 1886), Oakland, Cal.; W. I. Stringham (Ph.D., 1880), professor of mathematics, University of California; H. A. Todd (Ph.D., 1885), professor of Romance languages, Leland Stanford, Jr. University.

— Until the present century the policy of Europe, in dealing with crime and pauperism, was the best possible if the object had been to propagate and increase them both. The States of the New World necessarily copied many of the methods of the old. Unfortunately, along with much that was true and wise, they copied and perpetuated many old blunders. But with the advance of modern thought, especially with the enormous widening of the sphere of scientific knowledge, have come new and better ways of dealing with the defective, the criminal, and the pauper. To spread abroad and make popular the better ways in charity and reform is the object of the National Conference of Charities and Correction, which meets annually in one or other of our great cities, and will hold its Nineteenth Annual Session in Denver, Col., next June. It combines the best philanthropy of all creeds and all shades of political opinion upon the broad platform of humanity. Its programme for the year has just been issued, and is an interesting paper, its topics covering many of the social problems of the time. The membership of this conference is unique. It has no salaried officers and no selfish benefit to offer to anyone, so its doors are open to all the world; whosoever will may come in, on a footing of the most perfect equality. The fact that you are interested in its work, makes you a member, and entitles you to a seat and a voice in its discussions. Anyone desiring further particulars as to reduced railroad fare, hotel accommodations, etc., may address Alexander Johnson, secretary, Indianapolis, Ind., who will send circulars and answer inquiries.

— During the past two years a large number of variegated plants have been examined with reference to the presence of parasitic fungi by Byron D. Halsted, New Brunswick, N.J., who presented a paper before the Torrey Botanical Club Feb. 9. Attention was first called to the subject by a study of the foliage of a variegated ash, which had its leaves badly spotted with a species of *Coniothyrium*, while ordinary ash trees were free from the same fungus. Some of the variegated plants, both of the hardy sorts and those grown under glass, have been badly infested with leaf blights. Of the former may be named the delicate and popular bedding plant called plantain lily (*Funkia undulata*, var. *variegata*), several sorts of variegated pelargoniums and alternantheras. Among the most affected of the tender plants of the variegated class may be mentioned the *Aspedistra lurida*, var. *variegata*, *Ficus elastica*, var. *variegata*, *Abutilon Thomsoni*, *Codiæum*, sp. (crotons), *Dieffenbachia*, sp., *Hydrangea hortensis*, var. *variegata*, *Phrynium variegatum*, *Dracœna*, sp., etc. There seems to be no question that the variegated leaves are more susceptible, and that likewise the etiolated parts are the ones first attacked. The absence of green in a leaf, from this it is to be inferred, is a source of weakness, and upon this account the etiolated tissue is less able to resist the attacks of the fungus germs. Speaking generally, a variegated plant lacks capacity for the best work, and the gardener, in propagating a variegation, no matter how it may have originated, is propagating a weakened plant in so far as it has its normal amount of chlorophyll reduced. The fact that some sorts of the self-blanched celery have been found more susceptible to blights and decay bears directly upon this point. It is a pity that so many of our choicest variegated plants blight easily; it is, however, natural that they should do so. Even a fungus parasite will take the line of least resistance.

— At the last meeting of the Numismatic and Antiquarian Society of Philadelphia a number of the amulets recently presented to the Museum of the University of Pennsylvania by Mrs. John Harrison, who collected them during her recent journey in the East, were exhibited. Among others was a small stamped metal hand with a Hebrew inscription, worn by Jewish boys in Cairo on their foreheads. The inscription reads: *Ben Pórath Jósf*, "a young branch is Joseph" (Gen. xxii., 49), *Shaddai*, and "Jerusalem the Holy City." A green-stone talisman purchased at Jaffa bore an inscription in Arabic of Cufic type, reading "God is High." The hand gave rise to a discussion on the wide-spread use of the extended hand as a magical symbol. In Japan such a hand is frequently placed over the doorway as a charm, and its use in America was commented upon. The folk-lore collection comprising charms, games and a variety of objects in the University, receives constant accessions and is growing in interest.

— The *Bol. dell Instituto Geogr. Argentino*, Tomo xii. Cuad. v. y vi., contains a description of Tierra del Fuego by Dr. Polidoro A. Segers, who took part in an expedition in 1886, and since then has continued his observations during three consecutive years. The northern part of the island, explored by MM. Rousson and Willems, is covered with prairies, where no trees and few shrubs are to be found (see vol. vii., p. 536). To the south, however, of the line from Useless Bay to Cape Peñas the surface is clothed with forest, which gradually becomes more dense towards the south. Here the coast is more rugged and the shore is encumbered by rocks, harboring large numbers of sea fowl and a variety of molluscs. Fish also and seals are more abundant on the southern coasts. This difference in the animal kingdom causes a corresponding difference in the mode of life of the natives. Whereas in the north the Onas, or, according to Dr. Segers, Aonas, subsist on the guanaco and the *tucu-tucu*, a small rodent, the natives of the south, where these animals are seldom met with, are almost entirely dependent on the sea for their living. They catch seals with a decoy of seal skin stuffed with grass, which they draw through the water by a thong, imitating at the same time to great perfection the bellow of the animal. Birds they catch at night by torch-light, letting themselves down the cliffs by ropes of leather, and fish they take in nets made of sinews of the guanaco. In their dress and customs the southern Onas resemble their brethren of the north, with whom they are constantly at feud.

Their number, in consequence of frequent battles with their more numerous enemies, has been much reduced, and is now, probably, very small. They are very skilful in the use of the bow, and show some dexterity in the manufacture of arrow-heads of flint and glass and needles of bone, but they never make any improvements in their utensils and are utterly ignorant of art of the rude description generally found among savages. Tierra del Fuego is inhabited by six tribes of Onas, each of which speaks a particular dialect, though men of different tribes are able to converse together. Each man has his distinctive name, wherein the Onas differ from the Yaghan, who live on the Beagle Channel, and go out in their canoes to sell otter and seal skins to passing vessels.

— Among the most singular cats which have been introduced into Europe of late years are those known as the Siamese. They are coming into favor, and half a dozen old cats and several young ones in the kitten classes were exhibited last fall at the Crystal Palace show. The ground color of one was pale cream, slightly darker on the hind-quarters, the color of the extremities, that is to say, the muzzle, ears, and tail, and the four feet, being a very dark chocolate, approaching black.

— At a meeting of the board of directors of the American Association to Promote the Teaching of Speech to the Deaf, held at Washington, D. C., Jan. 18, it was decided to hold the annual summer meeting either at Manitou, Col., Lake George, N. Y., or at Northampton, Mass., and Mr. A. L. E. Crauter was appointed a committee to ascertain the relative advantages of these points. He reported to a meeting of the executive committee at the Parker House last week. The committee decided, after due deliberation, to hold the meeting from June 22 to July 1 inclusive, at Crosby-side Hotel, Lake George, N. Y. This will in no wise conflict with the proposed conference of principals and superintendents of deaf and dumb institutions in Colorado. At the meeting last week, Dr. A. Graham Bell presided. Among those present were Miss C. A. Yale, principal of the Clark Institution for the Deaf; Miss Sarah Fuller, principal of Horace Mann school, Boston; Prof. A. L. E. Crauter, principal of the Pennsylvania Institute for the Deaf, Philadelphia; Hon. John Hitz, superintendent of the Volta bureau, Washington, D. C., and others. The meeting adjourned subject to call of the president to hear the report of the committee of arrangements in regard to a programme.

— Mr. William Sowerby, the veteran and distinguished Secretary of the Royal Botanical Gardens, writes to the *British Medical Journal* the following note on his suggestion for adding to the number of alkaloid beverages by the introduction of coffee-tea: When walking in the Gardens of the Royal Botanical Society, Regent's Park, and noting the extent of the collection of living medicinal and economic plants of all climes and countries there brought together in one spot, it must have occurred to all of us how very small a number of plants, out of the vast store which Nature has provided, man has bound to his service, and the yet fewer he has taken the trouble to cultivate. During the march of the last half-century, in science, medicine, mechanics, steam, and electricity how little has been gained from Nature's stores. The artificial culture of cinchona is, perhaps, the most noted of the few. Again, any step in eating, drinking, dress, is so governed by habit or fashion that he must be a bold man who tries to turn the current. This is illustrated in tea drinking. Perhaps there is no one habit so universal; each people has its peculiar tea or closely allied beverage, and most of these have continued the same for many ages. In one it is cocoa, in others, coffee, and in many, tea; in a few special quarters of the globe nothing but *maté* is thought fit to drink, but in only one small district is coffee-leaf tea used. Now we all know that these beverages are found by man to be pleasant and agreeable to him by reason of their containing a peculiar principle called *theine;* but yet we do not always select for our use the part of the plant containing the largest percentage of *theine*, or cultivate the special plant with a view to afford us the most valuable part. For example, in coffee the leaves are said to contain 1.26 of theine, and the berries only 1.0 per cent, and yet over 110,000,000 of men use the berries, and only 2,000,000 the leaves of coffee, although 500,000 000 use the leaves of tea. Now the cultivation of coffee berries is very trying, precarious, subject to attacks of blight and unfruitfulness; in fact it follows the general line that the produce of fruit by cultivation is far more open to accident than that of the leaves, and very probably good crops of coffee leaves could be obtained at small cost in countries and localties where it would be risky or even impossible to produce berries. Here is a case open to a vast variety of people to solve, for there can be no reason why coffee leaves may not become a valuable item of culture in our warmer colonies and many parts of the world. The one most difficult item to move is to create the demand. Once start the fashion for "five o'clock coffee-leaf tea," and the thing is done, and many a fortune made. As to the peculiar flavor of coffee-leaf tea much depends on the manipulation of the leaf after it is taken from the plant. At the Botanic Gardens a variety of flavors have by treatment been produced from leaves off one plant, the general flavor being a kind of combination of coffee and tea so as to get both in one cup.

— The *St. Petersburger Medicinische Wochenschrift* gives a *résumé* of a paper by A. S. Ignatovski on the cause of death by hanging. He refers the rapid loss of consciousness after suspension to the retarded or arrested circulation in the brain brought about by the increased intra-cranial blood pressure. The effect of this impediment to the circulation is the same as in cerebral anæmia, for in both the nutrition of the brain suffers. It is therefore not, as Leofman teaches, an insufficient supply of blood to the brain, due to compression of the carotids, which interferes with the functional activity of the brain, but compression of the capillaries by increase of the intra-cranial pressure, which has this effect, and which occurs whilst the supply of blood remains the same, or even increases.

— We learn from *Nature* that a prize is offered by Schnyder von Wartensee's Foundation, Zürich, for the solution of the following problems in the domain of physics. "As the numbers which represent the atomic heats of the elements still show very considerable divergences, the researches conducted by Professor H. F. Weber on boron, silex, and carbon, regarding the dependence of the specific heats upon the temperature, are to be extended to several other elements, prepared as pure as possible, and also to combinations or alloys of them. Further, the densities and the thermic coefficients of expansion of the substances investigated are to be ascertained as carefully as possible." The following are the conditions: the treatises handed in by competitors may be in German, French, or English, and must be sent in by Sept. 30, 1894. The examination of the treatises will be intrusted to a committee consisting of the following gentlemen: Professor Pernet, Zürich; Professor A. Hantzsch, Zürich; Professor E. Dorn, Halle-on-the Saale; Professor J. Wislicenus, Leipzig; Professor E. Schär, Zürich, as member of the committee offering the prizes. The Prize Committee is empowered to award a first prize of two thousand francs, and minor prizes at its discretion to the amount of one thousand francs. The work to which the first prize is awarded is to be the property of Schnyder von Wartensee's Foundation, and arrangements will be made with the author regarding its publication. Every treatise sent in must have a motto on the title-page, and be accompanied with a sealed envelope bearing the same motto outside and containing the author's name. The treatises are to be sent to the following address: "An das Praesidium des Conventes der Stadtbibliothek, Zürich (betreffend Preisaufgabe der Stiftung von Schnyder von Wartensee für das Jahr, 1894)."

— John Wilson & Son, Cambridge, announce "Selections Illustrating Economic History Since the Seven Years' War," compiled by Benjamin Rand, Ph.D., assistant in philosophy, Harvard University. This is a second edition, revised and enlarged. The first edition of these selections was published as a text-book of required reading to accompany a course of lectures on economic history given at Harvard College. It was also adopted for a similar purpose by other American universities. A continued demand for the work has led to the preparation of the present edition. The design of the book has been to exhibit in a series of articles of permanent value different phases of economic thought, and to present in chronological order a narrative of some of the more important events and influences of modern economic history.

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CURRENT NOTES ON ANTHROPOLOGY. — II.

[*Edited by D. G. Brinton, M.D., LL.D.*]

Prehistoric European Migrations.

LITTLE by little the seemingly impenetrable veil which shrouded the wars and wanderings of European nations before history began is lifting. Scientific methods undreamed of half a century ago now reveal the secrets of ages too remote to date. We can trace man in western Europe steadily advancing through the development of a continuous culture from the rudest period of chipped implements of stone to an epoch when he learned to polish and bore that material, and finally threw it aside to arm his hand with a blade of glittering bronze.

The continuity of this development is one of the master generalizations from the long labors of Worsaae, Mortillet, and others. It has recently received further solid support in an excellent critical study by Dr. Sophus Müller, entitled "Instruments Tranchants de l'Ancien Age de Pierre," published in the *Mémoires de la Société Royale des Antiquaries du Nord*. It is especially devoted to the use of the triangular stone celts found abundantly in Denmark. They are shown to be tools, and to belong to the earliest stone age of that portion of the continent.

Neither they nor any of the relics from northern Europe carry us so far back in the past as some from France and the Iberian Peninsula. This fact leaves little room for doubt but that these latter regions were inhabited first. Even there the advent of man must be placed as a post-tertiary event. This is the mature opinion of such authorities as Topinard, Cartailhac, and especially of M. Alexandre Bertrand, whose excellent book, "Nos Origines," has recently appeared in a new edition. M. Bertrand is director of the National Archæological Museum at St. Germain-en-Laye, and a most conscientious student. From his and others' observations it appears that matters went smoothly enough in Europe down to Neolithic times; but then widespread migrations began. More than 1200 years B.C., thinks M. Bertrand, the Ligurians came down from somewhere up north, and conquered portions of the littoral of Spain, Gaul, Italy, and Sicily. The interior of France and the Iberian Peninsula was then peopled by "Iberians." Not far from the date mentioned these were driven westward by inroads of the Celts. He acknowledges, however, that there are no relics positively attributable to either Ligurians or French Iberians; and his theory therefore must be accepted as only one degree less unlikely than the purely gratuitous one of Virchow, who makes out the Ligurians to have been "Turanians."

In recent numbers of the *Globus* and *Ausland*, Karl Penka urges with renewed vigor his theory that Scandinavia was the original home of the Aryan stock; and that not very long before the beginning of our era the whole of central Europe was peopled by Celts. He has an earnest disciple in E. Krause, who lately issued a volume of nigh 700 pages on "Tuisko-Land," his name for Scandinavia, to which, with great wealth of learning, he traces both the myths of Hellas and the simple cults of pristine Rome.

Another ethnologist with his own notions is Dr. Theodore Köppen, librarian of the Imperial Library at St. Petersburg. In a pamphlet reviewed at length in the *Archiv für Anthropologie* (Band XX.) he insists that the Finnic and Aryan linguistic stocks are one in origin; that their ancestral home was somewhere about the region of the middle Volga; that the separation took place into eastern and western branches on the river Don; and that at that time arose the Aryan and Ugro-Finnic divisions. His arguments are principally linguistic, and he lays especial stress on the words for "honey" and "linden bast," which he finds the same in the two stocks. His work is principally interesting as showing the growing tendency among scholars to discard the old theory that the Indo-Europeans began in Asia, in favor of an origin in Europe; but Köppen repeats the familiar error of attributing the theory of the origin of the white race in Europe to Dr. Latham; whereas, long before he mentioned it, it had been urged with clearness by Omalius D'Halloy, the distinguished Belgian anthropologist.

Retrogressive Culture in Prehistoric Times.

The general law of the continuity of development holds good throughout historic and prehistoric time; but the careful archæologist will always bear in mind that, in both, periods of retrogression have occurred in many localities; and he will not, therefore, assign to relics of man's industry a later date solely on the ground of higher technical perfection. Often a tribe or nation has been conquered or destroyed by one ruder though stronger, and for generations a lower has followed a higher degree of art-produce.

Two or three examples of this in prehistoric times have recently been adduced. Mr. H. Stopes reports in the Proceedings of the British Association for the Advancement of Science, 1890, a curious station in the Thames Valley, where some tribe in the Palæolithic condition had overwhelmed one with Neolithic culture; and not understanding the use of the polished stone implements of the latter had chipped them into rough stone shapes! Not less remarkable was the discovery of the brothers Siret, in the caves and rock-shelters near Almeria, Spain, that the most ancient Neolithic potteries there are distinctly superior in make and ornament to those of later date. Something similar seems to be the case with the interesting series of potteries lately exhumed in the Neolithic station of Latinne, Belgium, by M. de Puydt. They

show a finish that we do not find in what appear to be later deposits.

Prehistoric Commerce Between Africa and Asia.

The ancient relations which existed between Egypt and the east coast of Africa on the one side, and Mesopotamia and India on the other, are placed in strong light by two articles which have lately appeared in the *Verhandlungen der Berliner Anthropologische Gesellschaft.*

The one, by G. Schweinfurth, undertakes to show the external relations of ancient Egypt by means of the origins of the earliest cultivated plants found in the tombs or mentioned in the inscriptions. Their three earliest and most valuable cereals, wheat, barley, and spelt, he believes were introduced from Babylonia. The fig was imported from southern Arabia, its native home. From Persia were brought the pomegranate and the henna used as a cosmetic by the beauties of the earliest dynasties. From the remoter region of India came rice, sorghum, sesame, and the sugar-cane. As all these exotic plants were familiar to the Egyptians at the beginning of their history, they testify to an active and far-reaching commerce before the date of Menes.

The second paper, by Mr. Merensky, is especially concerned with the culture influences of ancient India on eastern and central Africa. He adduces much historical evidence to illustrate this intercourse, and finds as the result of it the presence of Indian coral and pearls in central Africa, the shape of the hand axe, the musical instrument called the marimba, the use of the betel nut, the worship of fire, traces of a caste system, etc.

Both articles confirm the growing belief in the wide extension of prehistoric commerce.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

The Question of the Celts.

IN "Current Notes on Anthropology" (*Science*, Mar. 11) Dr. Brinton reviews a late essay by Schaaffhausen upon the ethnographic position of the Celts. He states: "The difficult problem of the conflicting physical types among the Celtic nations — the one short in stature, brachycephalic, and brown, the other tall, dolichocephalic, and blond — he [Schaaffhausen] summarily solves by supposing either an intermixture with other types or a change in mode of life and climatic environment."

The first mentioned type is apparently that now represented by the Auvergnats and Savoyards, whose ancestors were the Celts of Cæsar. Now Schrader has pretty well established the fact that this race has no claim to the name Celtic other than the fact that at one time they spoke a Celtic dialect. Rather they were Ligurians related socially to the Lapps and Finns; and their original language was that now represented by Basque, their Celtic dialect having been acquired from the tall, fair, brachycephalic race which conquered them, and drove them to the south of France. There should be no need to say that community of language does not necessarily imply identity of race; for one only has to look upon the Mexicans, who speak a Neo-Latin dialect, but whose race type has almost wholly reverted to that of the Aztecs. The French inhabitants of Louisiana cannot now be distinguished by their language, and the speech of Jamaica is an English jargon, though the population is now almost wholly negro. The fact that French is a Neo-Latin language by no means proves any racial connection between the Latins and the French, who are descended from several distinct races.

Now there is very good evidence that the tall, fair, brachycephalic people, whose remains are found in the round barrows of Britain and in the graves of Belgium, France, and Denmark, spoke the original Celtic tongue. They were the Belgic Gauls, and they overran France, conquering the short, dark, brachycephalic Ligurians and imposing their language upon them. The Ligurian tongue, ancestral to Basque, was a Euskarian dialect related to the Ural-Altaic group, which was ill-fitted to survive in contact with the Aryan speech of the northern race. The best modern representatives of the type of the conquering race are the Danes and Slavs, especially the Lithuanians.

The tall, dolichocephalic and blond type is certainly represented now by the Swedes, and fair north Germans, and has been well called the Scandinavian type. The Anglo-Saxons and Teutonic tribes belonged to this race, and their speech was ancestral to the German and English. If this be true, and the facts seem well attested, it is hard to see how this tall, fair, dolichocephalic type can be logically drawn into the Celtic controversy.

In conclusion, it would seem that the conflicting types among the Celtic nations are due solely to the application of the name Celtic to several distinct races, and if that name is restricted, as there is excellent ground for doing, to the tall, fair, brachycephalic race, the difficulty of conflicting types vanishes.

P. MAX FOSHAY.

Rochester, March 15.

The Color Question Again.

I NOTICE in your issue of Feb. 26 an article by Professor Pillsbury of Smith College, in which my name is mentioned in connection with a system of color instruction.

Perhaps an explanation of the exact scope and intention of this scheme may avoid any misapprehension of the claims that are made for it.

The sole object has been to apply, as far as possible, scientific facts of color to elementary instruction in color and the artistic use of color. While it is easy to find various indications that the old theory of Brewster has been abandoned by the scientists and the Young-Helmholtz theory of the three primaries, red, green, and violet, accepted in its place, no practical advance in the application of the latter theory to art instruction has been secured. The following quotation from the publishers' notice of a valuable book, "Theory of Color," by Dr. Wilhelm von Bezold, shows the advanced ground regarding color taken by this scientist: —

"The theory of three primary colors, red, yellow, and blue, has therefore been abandoned, and with them the whole system of so-called secondary and tertiary colors has fallen to the ground. It might be feared that anarchy would take the place of order in the realm of color after the overthrow of the old system of classification. This is not the case, however, for the system of colors adopted by Professor von Bezold not only affords a ready means of classifying every sensation of color which may possibly affect the eye, but is exceedingly simple."

But experience has shown that this book, although the ablest attempt to unite the scientific theory of color with the practical use of colors ever offered at the time it was published, has, in the sixteen years since the English translation was printed, had no practical effect on the terms employed by the artists or on the methods employed in color instruction.

Owing to the fact that the illumination and purity of all pigmentary colors fall so far below the spectrum colors as found in sunlight, it it impossible with them to produce by the union of the three primaries, red, green, and violet, any reasonable approximation to the colors seen in nature. Therefore it has been practically impossible for artists and art educators to avail themselves of the scientific theories of color in their work.

Right here is where we find the real value of the system to which Professor Pillsbury has alluded. It practically bridges the chasm between the science of color and the practice of color in the use of pigments. Instead of beginning with three primary colors seen in the spectrum we are content to select six. By choosing six colors, red, orange, yellow, green, blue, and violet, as they appear in the spectrum, making the best imitations of

them possible with pigments, and applying these to the Maxwell rotating disks, with the addition of black and white, we can make and accurately name a very large proportion of all the colors found in nature which also agree somewhat nearly with similar pigmentary compositions.

As above stated, this system of color instruction includes a practical nomenclature of color never before advanced, which has already been explained by Professor Pillsbury. Professor A. H. Church of the Royal Academy of Arts, in a series of lectures before the Society of Arts, London, an account of which has been published in this country, urges a scientific consideration of color in its application to art, and near the close of one of his lectures he says:—

"We want an international color conference, in which artists, manufacturers, and scientists shall be represented. We want an agreement upon the name to be assigned to a number of different hues. We want representations of these hues reproduced in enamel, preserved like our standards of weights and measures, and distributed to every educational institution in the United Kingdom. . . . The importance of having a definite nomenclature of quite intelligible character at our disposal when we are talking or writing about the decorative employment of color is so important that I venture to make a few suggestions which may tend toward the attainment of this object."

After making a suggestion for a method of notation, Professor Church adds: —

"The corresponding modifications in the five other principal series of colors would be expressed in a similar manner, the symbols, etc., being used exactly in the same way as in chemical notation. In order to obtain a scale in a concrete form I would recommend the use of Maxwell's rotation method by which each step in the gradation could be matched."

This author next proceeds to give a nomenclature of colors, but as it is based on the three primary colors of the scientist, namely, red, green, and violet, and the introduction with them of such additional terms as sea-green for a symbol, it is neither as simple nor as definite as the one which has been described in your article to which I have referred. This nomenclature is based solely on nature's standards as found in the solar spectrum. Should we be favored with the international conference suggested by Professor Church, and should such a conference adopt the six standards and definitely locate them in the spectrum by their wave lengths, the world would then have standards which are the same in one country as in another, and would remain the same in the twentieth century as in the nineteenth.

As a manufacturer of an extended line of colored papers I am constantly putting this proposed nomenclature to a severe test by ordering new colors by telephone. That is to say, we make the desired combinations on the wheel in our office and then telephone them to the factory, ten miles distant, where they are again made on the wheel and the papers are then manufactured to correspond with the results of these combinations. Under this plan we are liable to have occasion to "telephone a color" frequently. In the same way we could cable colors to Europe should it be necessary. MILTON BRADLEY.

Springfield, Mass., March 17.

Professor Alexander Agassiz on the Origin of the Fauna and Flora of the Galapagos Islands.

IN the "General Sketch of the Expedition of the 'Albatross' from February to May, 1891" (Bull. Mus. Comp., Zool., Harvard College, Vol. xxiii., No. 1, Cambridge, Feb., 1892) Professor Alexander Agassiz refers to my paper "On the Origin of the Galapagos Islands" (*Am. Nat.*, March-April, 1891). There are some fundamental misunderstandings of my statements in Professor Agassiz's remarks, which need correction.

Page 71, he says: "He [Baur] speaks of the Galapagos as being connected with the mainland by the 4,000-meter line." Then he adds "This [the connection of the Galapagos with South America] is an important fact; all the older maps showed the Galapagos separated from Central America" (!). To this I have to reply, that I never expressed the opinion that the Galapagos were formerly connected with South America. The same is repeated by Professor Agassiz in two other passages (p. 71).

In all my statements in regard to the land connections I was very cautious, as will be seen from p. 310: "*In their general characters the fauna and flora of the Galapagos show resemblances to the great Mexican and Sonoran province, and also to the West Indies, and it may be that the connection was with these regions (and it seems more probable than any other), but of course it is quite impossible to bring to-day any positive proof for this idea.*" (The italics are mine.)

According to Professor Agassiz the proof of my subsidence theory "is based on no better evidence than the so-called alpine character of parts of the flora and upon the presumed former connection of the Galapagos Islands with the Central American continent." Professor Agassiz has completely overlooked the main point of my argument. This I considered the harmony in the distribution of fauna and flora, as will be seen by referring to my paper. I tried to show that this harmony was absolutely unexplainable by the theory of elevation. After this was done, I examined whether our present knowledge of the soundings showed any serious obstacle to the theory of subsidence, and I found that it did not. *Professor Agassiz did not refer with one word to this harmony of distribution, which formed the basis of my whole ideas!*

When Professor Agassiz or any one else is able to explain this by the elevation theory, I shall be the first one to adopt it. But until this has been done, I believe in subsidence.

The paper to which Professor Agassiz refers was written before my visit to the islands. My investigations have only more convinced me of the insufficiency of the elevation theory. In my final work I shall speak fully about this question and about other points in Professor Agassiz's article. G. BAUR.

Clark University, Worcester, Mass., March 15.

The Scientific Alliance.

I HEARTILY agree with your leading article of March 11, and trust that you will continue to press this subject. The further co-operation of the scientific societies in this city will result, I feel confident, in increased activity and effectiveness in each.

The special needs of many branches of work now being carried on here are more funds for publication and for first-class illustration. There is no national publication open to all papers of merit, like the Royal Society Transactions. The only journal I know of which provides liberally for illustration is Whitman and Allis's *Journal of Morphology*, and this is now, I have learned, overstocked for two years to come with biological papers of a high class. HENRY F. OSBORN.

Biol. Dept., Columbia College, March 18.

BOOK-REVIEWS.

Travels amongst the Great Andes of the Equator. By EDWARD WHYMPER. New York, Scribner's. 8°. $6.

AMONG the fascinating books of Professor Tyndall's is one on "Hours of Exercise in the Alps," in which, among other matter, he records the several unsuccessful attempts he made to ascend the Matterhorn, and how the rope left, by his party, hanging over a ridge of rocks enabled the next following party of climbers headed by Edward Whymper to gain such advantage as to be able to reach the top. This first success was marred by a terrible tragedy, only three or four of the party of seven getting back to the foot of the mountain alive.

But Edward Whymper added another triumph to his record as a mountain climber in his being the first to reach the summit of Chimborazo in 1879. It is the account of his journey at that time that is now published.

A hundred years ago the natives of the valley of Chamonix who took travellers up the mountain suffered as much as their employers from physical sensations ascribed, no doubt rightly, to the rarity of the air. They were unable to walk more than a few paces without halting. Last autumn travellers who walked in early morning from the hut under the Bosses (14,000 feet) to the top (15,780 feet) had the company of five Chamoniards. They

went up at a fair pace without resting. Arrived on the top, without a moment's pause, the men took their spades and shovels and began digging. They asserted that they did only about a third less work in the day than in the valley; and that they suffered no inconvenience from a prolonged stay in the Bosses hut; slept well, and ate largely. Their work was to excavate a tunnel in the summit ridge about thirty feet below the top. The object of this tunnel was to reach rock, in which a shelter-cave might be excavated.

Mountain-sickness is a term which has been used during the nineteenth century to designate the ailments which come to men and beasts on reaching high elevations on mountains. Some supposed that the uncomfortable symptoms were the result of local causes, and did not depend solely on reduced atmospheric pressures, as is the opinion of Mr. Whymper.

It was largely with a view to settle various questions in regard to mountain-sickness that the journey to the Andes was undertaken. Mr. Whymper wished to learn: (1) at what pressure the symptoms would first appear; (2) what form the sickness would take; (3) whether one could become habituated to low pressures.

To the first question the answer came at a pressure of 16.5 inches. Most of the party were simultaneously incapacitated for work and found themselves preoccupied by the paramount necessity of obtaining air. Precautions had been taken not to introduce complications in the way of physical exhaustion, Mr. Whymper maintaining "that our 'incapacity' was due neither to exhaustion nor to deficiency of bodily strength, nor to weakness from want of food, but was caused by the whole of our attention being taken up in efforts to get air." This gasping for air was accompanied with intense headache and an indescribable feeling of illness, pervading the whole body. The attack was sudden, but the recovery gradual; and even at the best it was only while at rest that sufficient air could be secured through the nostrils; on exerting themselves it was necessary to breathe through the mouth as well, and the capacity for work was low.

In reviewing the whole of their experiences, two different sets of effects could be distinguished: those which were transitory, and those which remained so long as the party was exposed to low pressures. The transitory effects were acceleration of the circulation, and increase in temperature. The permanent ones were more rapid respiration, indisposition to take food, and lessening of muscular power.

In the opinion of Mr. Whymper, the mountain-sickness is due to diminished atmospheric pressure, which operates in two ways: by lessening the value of the air inhaled, and by allowing the gases within the body to expand and seek partial escape.

But aside from the value of the book as a record of investigation on mountain-sickness, which is, by the way, made by no means prominent, we have in "Travels amongst the Great Andes of the Equator" a most valuable record of travel, well written.

A "Supplementary Appendix," to which some fifteen prominent naturalists contribute, is devoted to the collections made in the Andes, a very considerable part being on the coleoptera. The ample number of plates and illustrations make the whole work one of special value as a scientific record, and the account of the journey is most entertaining.

Order in the Physical World and its First Cause According to Modern Science. From the French. New York, James Pott & Co. 12°. $1.

Natural Law in the Spiritual World. By HENRY DRUMMOND. New York, James Pott & Co. 12°. 75 cts.

THESE two works are eminently characteristic of the present time. The relations between science and religion have been the constant theme of comment and controversy for the past thirty years, and still excite extraordinary interest in certain classes of minds. Persons of an atheistical turn point to certain discoveries and theories of science as negativing the very idea of religion; defenders of Christianity repel the charge; while a third class of writers endeavor to reconcile the two conflicting systems of thought by finding some rational ground of agreement. The two works now before us belong to this last category. The first, which is translated from an anonymous French writer, is an adaptation of the design argument to the present state of scientific knowledge; the discoveries of science themselves furnishing the basis on which the argument rests. It is not a profound work nor in any way original; and it will not satisfy minds thoroughly imbued with the skepticism so characteristic of the present time. But for those who think the design argument a convincing one the book will have an interest. Unfortunately the English of the translation is imperfect and sometimes ungrammatical, especially in the earlier pages, and typographical blunders, such as "sideral" for sidereal, "Emmerson" for Emerson, etc., are altogether too frequent.

The second volume before us is of a different character, and somewhat curious. The author, Mr. Drummond, as he tells us in his preface, had been employed for some years in teaching the natural sciences on week days and lecturing upon religious themes on Sundays. Naturally, and almost necessarily, he was led to a study of the relations between the two subjects and to seek some basis of agreement between them. The result appears in this book, in which he endeavors to show that the laws of biology, which are manifest in organic life, are no less manifest in religious, or, as he calls it, spiritual life. Analogies between organic life and the mental and moral life of man have often been pointed out before; but Mr. Drummond maintains there is something more than analogy in the case, that the very same laws operate in these widely different spheres. We cannot think, however, that he proves his thesis, the resemblances that he points out between the natural and the spiritual world being, in spite of his disclaimer, nothing but mere analogies, and often remote and fanciful analogies. For instance, he speaks of the law of biogenesis, that life can only come from antecedent life, and argues that this is the same as the Christian doctrine that a man must "be born of water and of the spirit" in order to enter the Kingdom of God. He even speaks of "spiritual protoplasm," and declares that the difference between a Christian and a good man who is not a Christian is the difference between the living and the dead. As poetic analogies between natural and spiritual things, some of the resemblances that Mr. Drummond dilates upon have a certain interest, and serve well to illustrate moral and religious truth; but as the basis of scientific doctrine and as proving the reign of law in the spiritual world, they are of little value.

AMONG THE PUBLISHERS.

THE exclusive authorization to issue an English translation of the "Memoirs of the Baron de Marbot," which have created unusual interest in Paris, has been acquired from the Baron's representatives by Longmans, Green, & Co. They will publish the work immediately, both in New York and London.

— P. Blakiston, Son, & Co. have brought out a second edition of Blair's "The Organic Analysis of Potable Waters." Considering that the first edition was published but little over a year ago, this shows that the book has proved a good one.

— Messrs. Eason & Son, Dublin, will issue in April the first number of the *Irish Naturalist*, a monthly journal of general Irish natural history, and the official organ of all the natural history Societies in Ireland. The editors will be Mr. George H. Carpenter and Mr. R. Lloyd Praeger.

— A new *Physical Review* has been started by the publisher, J. Engelhorn, of Stuttgart. The editor is L. Graetz. The object of this periodical will be to make German readers acquainted with the work being done by physicists in other countries. It is intended that it shall serve as a sort of supplement to the well-known *Annalen der Physik und Chemie*.

— W. B. Saunders, 913 Walnut Street, Philadelphia, has published, as No. 22 of Saunders's Question Compends, "Essentials of Physics," by Fred. J. Brockway, M.D. The book is arranged in the form of questions and answers prepared especially for students of medicine. The author is assistant demonstrator of anatomy at the College of Physicians and Surgeons, New York. The reasons assigned for the existence of the book are that Ganot is too large for the purposes of medical students and that some of the other text-books do not contain enough.

— *Natural Science* is a new monthly review of natural history progress. The object of the editors will be "to expound and deal in a critical manner with the principal results of current research in geology and biology that appear to be of more than limited application." Articles are contributed to the first number by Mr. F. E. Beddard, Mr. J. J. H. Teall, F.R.S., Mr. A. S. Woodward, Mr. R. Lydekker, Mr. J. W. Davis, Mr. G. A. Boulenger, Mr. J. W. Gregory, Mr. G. H. Carpenter, and Mr. Thomas Hick. The publishers are Messrs. Macmillan & Co.

— Every teacher of physics will be glad to know that a tenth edition of Maxwell's "Theory of Heat" has just been issued by Longmans, Green, & Co. Lord Rayleigh is the editor, which is sufficient to make all physicists confident that the necessary revision has been well done. It is probable that no more suggestive work was ever produced in the whole science of physics. It is more than its name signifies, for a number of physical problems are discussed, which are not usually treated under the head of "heat." But no one should take up the book unless he is prepared for some pretty intense study. It is not a popular work, but for those competent to understand even portions of it it stands without any equal as a guide to the study of physical science.

— "A Guide to the Scientific Examination of Soils: Comprising Select Methods of Mechanical and Chemical Analysis and Physical Investigation" is the title of a book recently published by Henry Carey Baird & Co., Philadelphia, at $1.50. It is a translation from the German of Dr. Felix Wahnschaffe, with additions, by William T. Brannt. Mr. Brannt is editor of "The Technochemical Receipt Book." The "Guide to the Scientific Examination of Soils" is a book for the agricultural chemist. There are introductory chapters on "Derivation and Formation of the Soil," and "Classification of Soils"; but these are brief, and the main purpose of the work is shown in the chapters bearing more directly on methods, mechanical and chemical, to be used in determining the soil-constituents and their plant-nourishing value. This last depends, as is well known on more than mere chemical constitution, and due attention is given to the determination of the properties of the soil depending on physical as well as chemical causes.

— The name of nearly every appliance on the English railway is different from the corresponding term applied on the American railroad, yet many of the problems involved in the working of rail transportation are the same. Only three or four years ago a lecture on "The Working of an English Railway" was delivered before the School for Military Engineering at Brompton Barracks, England, by George Findlay, who, in addition to holding certain rank in the volunteer service of England, is general manager of the London and Northwestern railway. This lecture was naturally devoted, to some extent at least, to the use of railways in military operations. It proved attractive, however, to a wider circle of readers than the army officers to whom it was first delivered, and the result was the first edition of "The Working and Management of an English Railway." Additions to the scope of the original lecture were made to adapt it to its new public, with the result that we now have before us the fourth edition, published in this country by Macmillan & Co. The subjects treated range all the way from such as are purely mechanical—the permanent way, rolling stock, signals, telegraphs, etc.—to questions concerning the relation of the state to railways and the state purchase of railways, which are to some extent social. There are some imperfections in the mechanical execution of the book, perhaps due to the large number of copies printed, but it is sure to interest all who want a popular *exposé* of the ways in which the modern railway has been brought into existence and the problems occupying the minds of those now managing them.

— Fleming H. Revell Company, New York, are the American publishers of "Heroes of the Telegraph" ($1.40), by J. Munro, which is brought out in England by The Religious Tract Society. Mr. Munro has written a number of popular books on electricity and the lives of workers in this comparatively new science. As an Englishman, he gives first place to Sir Charles Wheatstone among the heroes of the telegraph, and no one will wish to withhold any of the honors due that great pioneer in electrical science, especially as the author, in his second chapter devoted to S. B. F. Morse, does full justice to him whom we Americans are proud to consider as the inventor *par excellence* of the telegraph. But it is not with him that work on the telegraph ceased. Much work remained to be done before sub-marine cables and long and complicated land-lines were a possibility, and so there are chapters containing interesting accounts of the contributions to the telegraph made by Sir Wm. Thomson, Sir Wm. Siemens, Fleeming Jenkin, Reis, Bell, Edison, Hughes, Gauss, Weber, Sir W. F. Cooke, Bain, Dr. Werner Siemens, Latimer Clark, Count du Moncel, and Elisha Gray.

— So many ask for a really good elementary book in electricity and magnetism that we are inclined to hope much usefulness for "A First-book of Electricity and Magnetism" (60 cents), by W. Perren Maycock, recently brought out by Macmillan & Co., on this side of the water. The book is an English one, the author being a member of the English Institute of Electrical Engineers. The author does not touch upon the modern electrical theories, which are attracting so much attention, but which would be extremely unpromising subjects for popular exposition as they now stand; but he certainly seems to give a clear statement of the facts of electrical science in a way likely to be helpful to many who have not the training to use such excellent books as those by Silvanus Thompson or Fleeming Jenkin.

— Another book intended to serve the same purpose as that mentioned above has been published by Norman W. Henley & Co., New York, entitled "Electricity Simplified," by T. O'Sloane. The author of this book has met with success as a writer of primers on scientific subjects, his "Home Experiments in Science" and "The Arithmetic of Electricity" being doubtless known to many of our readers. There is certainly a demand for an elementary book that will tell the uninitiated something of the wonders of electricity, and all seeking such information should examine Sloane's "Electricity Simplified." ($1.).

— A notable literary article will appear in the April *Forum* by Mr. Philip G. Hamerton, who discusses the important subject of the Learning of Languages. Mr. Hamerton is one of the few men who are absolutely as much at home in French as in English, and his experience and observation make his article full of suggestiveness. The historian, Professor Edward A. Freeman, writes an autobiographical essay showing the growth of his opinions and method of work. Mr. R. L. Garner, the student of the speech of monkeys, contributes the most interesting paper that he has yet published on the results of his investigations. Other articles in this number will be on the German Emperor's policy of removing restrictions upon trade, by Mr. Poultney Bigelow, his personal friend; on German Colonization and Emigration, by Dr. Geffcken; an explanation of the method of burial by the great funeral monopoly in Paris, by Mr. Edmund R. Spearman, who has made a special study of it for the *Forum*.

— "Age of the Domestic Animals" is a treatise on the dentition of the horse, ox, sheep, hog, and dog, and on the various other means of determining the age of these animals, by Rush Shippen Huidekoper, M.D., veterinarian (Alfort, France); professor of sanitary medicine and veterinary jurisprudence, American Veterinary College, New York. This work presents a study of all that has been written on the subject from the earliest Italian writers. The author has drawn much material from the ablest English, French, and German writers, and has given his own deductions and opinions, whether they agree or disagree with such investigators as Bracy Clark, Simonds (in English), Girard, Chauveau, Leyh, Le Coque, Goubaux, and Barrier (in German and French). The illustrations have been mainly taken from these authors, and it would be extremely difficult to improve upon them. There are, however, a large number of original illustrations on the horse, cattle, sheep, and pig. To quote from the preface, "The author has attempted to prepare such a book as he feels would have been of interest and service to himself in his association with animals as a layman, and would have aided his studies and appreciation of the anatomy of the teeth, dentition, and means of determining

the age. He hopes, also, that this work will furnish, to students and veterinarians, knowledge which will aid in surgical operations on the mouth." The publishers are, F. A. Davis & Co., 1231 Filbert Street, Philadelphia.

— Macmillan & Co. will issue early in April an important work by Professor J. Henry Middleton on the "Remains of Ancient Rome," comprising two fully illustrated volumes.

— Messrs. Gauthier-Villars have published a work entitled "Leçons de Chimie," by Henri Gautier and Georges Charpy. It is intended mainly for the use of students of special mathematics.

— Professor Geo. J. Romanes has arranged with the Open Court Publishing Co. to bring out the American edition of his latest work, "Darwin and after Darwin." It will be published simultaneously with the English edition.

— Mashonaland, in south Africa (called "the future gold-fields of the world"), will be described in the April *Scribner* by Frank Mandy, a member of the Pioneer Corps which opened up the country for settlers. He has spent many years in that region, and is an acknowledged authority upon it.

— An excellent series of "Museum Hand-Books" is being issued by the Manchester Museum, Owens College. A "General Guide to the Contents of the Museum" has been prepared by Mr. W. E. Hoyle, keeper of the Museum, and Professor Milnes Marshall has drawn up an "Outline Classification of the Animal Kingdom," and a "Descriptive Catalogue of the Embryological Models."

— We learn from *Nature* that the first part will shortly be issued by Messrs. Dulau & Co. of a new botanical publication, to be called British Museum Phycological Memoirs, edited by Mr. George Murray. It will be devoted exclusively to original algological papers, the records of research carried on in the Cryptogamic laboratory of the British Museum in Cromwell Road, and is intended to be issued at about half-yearly intervals. The first part will be illustrated by eight plates, and will contain, among other articles, the description of a new order of Marine Algæ.

— There is evidently, in the opinion of one man at least, a perfect climate in one portion of the United States. The man is P. C. Remondino, M.D., and the place is Southern California. The beauties of Southern California Dr. Remondino sets forth in "The Mediterranean Shores of America," just published by F. A. Davis & Co., Philadelphia. After speaking of the beautiful adjustment of humidity to temperature, so that hot, muggy days are unknown, our author goes on to tell of the calm character of the weather, which is such that thunder-storms are almost unknown, and the signal office at San Diego, after eight years' waiting, found the storm flags of no use and returned them to Washington. Southern California, our author maintains, has as varied a climate as that of the north of Italy, or even more extremes of condition, but, with these extremes, enjoys the anomalous condition of having these extremes alike favorable to health and long life — just the reverse of northern Italy. The book is, of course, intended to convey such information as those seeking a health resort desire.

— The American Academy of Political and Social Science, with headquarters at Philadelphia, announce for early publication the following monographs on political and economic subjects: "Ethical Training in the Public Schools," by Charles DeGarmo, president of Swarthmore College, an essay which is intended to prove the necessity of moral instruction in our public schools, but to show that it need not necessarily be religious; "The Theory of Value," by the Austrian economist, F. von Wieser, a scientific explanation of the views of the Austrian school on this subject; "Basis of Interest," by Dwight M. Lowrey, a reply to Henry George's doctrines on this question. They will also publish at an early date a monograph on "Party Government," by Charles Richardson, which is a severe attack on the theory that devotion to party is a political virtue; and a pamphlet by J. R. Commons of Oberlin College on "Proportional Representation," in which a plan is disclosed which will prevent gerrymandering and secure minority representation.

— "The Will Power: its Range in Action," by J. Milner Fothergill, is a small book published by James Pott & Co. It is not a metaphysical essay, but a practical work on the importance in human life of strength of will, which the author regards as the principal thing in man's character and the main source of one man's influence over others. The different aspects of the subject, such as the will in relation to heredity, the will and circumstances, etc., are treated of, and some interesting anecdotes related to illustrate the author's doctrine. From the doctrine itself, however, we are obliged to dissent, because it puts strength of will above rightness of will, force above virtue. The highest principle in man is not will but conscience; conscience is the lawgiver, while the will's business is to obey, but Mr. Fothergill shows no sufficient appreciation of this fact. He admits, indeed, that strength of will may be used for evil as well as for good, and in many of the examples he adduces what he calls strength of will is merely selfishness or a domineering temper. Yet he expressly says: "Mighty as the will is, the first numeral in character, the next is principle in this world; in the next world, we are told, principle will come first" (p. 181). Such a doctrine, if carried into practice, would lead directly to immoral conduct; and we cannot, therefore, recommend this book as a means of moral instruction.

— The American Academy of Political and Social Science has just published a monograph by Leo S. Rowe on "Instruction in French Universities." This is the fifth of the monographs which they have issued treating of instruction in political science, etc., in various countries. Of the other four, two treated of German universities, one of the University of Oxford, and one of Italian universities. They also published a pamphlet on Jurisprudence in American Universities. The present essay gives a careful exposition of the system of faculties in vogue in France, together with a brief history of the higher educational system from the time of Napoleon to the present. It also explains the new system of universities which is now being advocated. Mr. Rowe then discusses the courses in political science, etc., which are offered by the law faculties and the other institutions, such as the École Libre and the Collège de France. The monograph concludes with some very valuable university statistics and a complete list of the instructors in political science and public law in the various institutions of higher education in France.

— The latest issue in the "Contemporary Science Series," published in England by Walter Scott and imported here by Charles Scribner's Sons, is a work by Karl Pearson entitled "The Grammar of Science." It is a discussion of the scope and method of science and of some of its fundamental principles. The author sneers at metaphysics, declaring both metaphysics and natural theology to be pseudo-sciences; and yet his own book is metaphysical from beginning to end, only it is bad metaphysics. Mr. Pearson adopts the subjectivist, or "idealist" theory of knowledge, which denies the existence of a real material world and regards external objects as nothing but groups of sensations. He adopts Kant's theory of space and time, though he derides Kant for being a metaphysician. His view of causation is borrowed of Hume; and he maintains that the business of science is merely to describe facts, not to explain them. "Science," he says, "deals with the mental, the inside world," and a law of nature is not an order of external facts but merely a "routine of perceptions." He alludes to Newton's formula of gravitation, and then goes on to say: "The statement of this formula was not so much the discovery as the *creation* of the law of gravitation. A natural law is thus seen to be a *résumé* in mental shorthand, which replaces for us a lengthy description of the sequences among our sense-impressions. Law in the scientific sense is thus essentially a product of the human mind and has no meaning apart from man. It owes its existence to the creative power of his intellect There is more meaning in the statement that man gives laws to Nature than in its converse that Nature gives laws to man" (p. 104). Such is the burden of the whole book, and it is thrust forward on every possible occasion; and it shows, we think, with sufficient clearness the mental calibre of the author and the quality of his book.

— The first number of the new *Zeitschrift für Anorganische Chemie*, edited by Professor Krüss, of Munich, was issued on Feb. 27. As its title implies, the new journal is devoted exclusively to

the inorganic branch of chemistry, and the names of the distinguished chemists throughout Europe and America whose co-operation the editor has been fortunate in securing would appear to promise well for its value and success. The first number, says *Nature*, contains the following six original memoirs: "Phosphorus Sulphoxide," by T. E. Thorpe and A. E. Tutton; "The Double Acids of Heptatomic Iodine," by C. W. Blomstrand; "The Action of Hydrogen Peroxide upon certain Fluorides," by A. Piccini; "Ammoniacal Platinum Compounds," by O. Carlgren and P. T. Cleve; "Preparation of Tungstates free from Molybdenum," by C. Friedheim and R. Meyer; "A Lecture Experiment," by C. Winkler.

— "Humanity in its Origin and Early Growth," by E. Colbert, is a work recently issued by the Open Court Publishing Company of Chicago. It is, of course, mainly historic in character, and much that it contains is familiar. The history of religion is the leading topic in it, but considerable space is also devoted to the origin and growth of language and the rise of the industrial arts. The book, however, is full of crude and often fantastic theories, the author being one of those men, by no means rare in these days, who have thrown off all traditional religious belief and taken an attitude of religious skepticism, but are, nevertheless, extremely credulous of new-fangled theories and alleged scientific discoveries. Thus Mr. Colbert tells us with an air of assured conviction that man originated at the North Pole, and also that some thousands of years hence most of the land in the northern hemisphere will be submerged by the ocean, while a vast southern continent will arise from the waters. Religion, he thinks, originated in the worship of the heavenly bodies; and expressly says that the Greek and Roman Jupiter is nothing else than the planet of that name (p. 230). He thinks that religion was mainly the work of the priests, who used the popular belief in astrology and magic as a means of domineering over men; and he nowhere shows any conception of the grandeur of the religious sentiment nor any respect for the religious beliefs of mankind. Yet he is half inclined to believe in astrology himself, holding that "a great deal may be said in justification of the old-fashioned idea of stellar and planetary rule over the affairs of men" (p. 390). Altogether the book is a curious one, especially as revealing the character of the author's own mind.

— Houghton, Mifflin & Co., have recently issued a large-paper edition (of 250 copies) of "The Discovery of America," by John Fiske, a work in four volumes, forming the beginning of Mr. Fiske's history of America, and the most important single portion yet completed, written upon original sources of information regarding ancient America, the Spanish conquest, mediæval trade, questions about Columbus, the causes of the transfer of supremacy from the Spanish race to the English, etc. The work contains abundant foot-notes, which are the results of vast research. We understand that the whole of this large-paper edition has al-

CALENDAR OF SOCIETIES.

Chemical Society, Washington.

Mar. 10. — H. W. Wiley and Wm. H. Krug, The Solubility of some Inorganic Salts in Acetone and of Acetone in Dextrose Solutions; H. W. Wiley and K. P. McElroy, The Specific Gravity of Acetone and Mixtures of Acetone and Water.

Publications received at Editor's Office.

DRUMMOND, HENRY. Natural Law in the Spiritual World. New York, James Pott & Co. 12°. 438 p. 75 cts.

FOTHERGILL, J. MILNER. The Will Power; its Range in Action. 3d. ed. New York, James Pott & Co. 12°. 184 p. 60 cts.

MAXWELL, J. CLERK. Theory of Heat. 10th ed. New York, Longmans, Green & Co. 16°. 357 p. $1.50

MEYER, LOTHAR. Outlines of Theoretical Chemistry. Trans. by D. Phillips Bedson and W. Carleton Williams. New York, Longmans, Green & Co. 8°. 282 p. $2.50.

ORDER in the Physical World, and its First Cause according to Modern Science. From the French. New York, James Pott & Co. 12°. 247 p. $1.

PEARSON, KARL The Grammar of Science. London, Walter Scott. New York, imported by Charles Scribner's Sons. 12°. 510 p. $1.25.

TILLMAN, S. E. Elementary Lessons in Heat. 2d ed., revised and enlarged. New York, John Wiley & Sons. 8°. 172 p.

WHITELEY, J. LLOYD. Chemical Calculations. New York, Longmans, Green & Co. 12°. 114 p. 60 cts.

WORTHINGTON, A. M. Dynamics of Rotation. New York, Longmans, Green & Co. 12°. 167 p. $1.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

For sale or exchange, Das Ausland, 10 vols., 1882 to 1891, including 6 vols. bound, 4 in numbers. Wheeler Survey, vol. 1. Geog. Report; also vol. 6, Botany; Production of gold and silver in the United States, 1880, '1, '2, '3, '5; Selfridge Isthmus of Darien. Will sell at very low prices. J. F. James, 1443 Corcoran St., Washington, D. C.

For exchange.—A fine thirteen-keyed flute in leather covered case, for a photograph camera suitable for making lantern slides. Flute cost $27, and is nearly new. U. O. COX, Mankato, Minn.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, can have the 'Want' inserted under this head at 10 cents a count line. Nothing inserted at less than 50 cents a time prepaid by stamps, if most convenient.

TRANSLATOR wanted to read German architectural works at sight (no writing). One familiar with technical terms desired. Address "A.," Box 149, New York Post Office.

WANTED.—A position in a manufacturing establishment by a manufacturing Chemist of inventive ability. Address M. W. B, care of *Science*, 874 Broadway, N. Y.

WANTED.—Books on Anatomy and Hypnotism. Will pay cash or give similar books in exchange. Also want medical battery and photo outfit. DR. ANDERSON, 182 State street, Chicago, Ill.

WANTED.—A college graduate with some normal training, to teach the sciences, at $1,800 per year, in a Southern college. A Baptist or a Methodist preferred. Must also be a first-class Latin scholar. A. H. Beals, Box K, Milledgeville, Ga.

A PROFESSORSHIP in Chemistry is wanted by one who has had five years' experience in that capacity. Would prefer to give instruction by lectures and experiments rather than by text-book methods. Would like a position in a college or university where there is a good student's laboratory. Special points of strength claimed are: (1) Thorough control of a class and good order during lectures and recitations. (2) Accuracy in experimenting with chemicals and skill in the manipulation of chemical apparatus. The permission of several distinguished educators has been given to refer to them if required. Would not care to accept a position paying less than $1,500. Address B. E., care of *Science*, Advertising Dept., 47 Lafayette Place, New York.

ADDRESS WANTED.—Will some one please send the address of the Secretary of the American Philological Society. Also that of Herbert Spencer. "ADDISON," Room 84, 164 Madison St., Chicago, Ill.

ADDRESSES of Old Book Dealers wanted.—Wishing to obtain a number of old books out of print, I very much desire the addresses or catalogues of rare second-hand book dealers. If there is a directory or list of such dealers I should like to obtain possession of one. W. A. BLAKELY, Chicago, Ill.

WANTED.—(1) A white man versed in wood and iron working, able to work from specifications and plans, suited for an instructor of boys; his business to have charge of shops of school, outline and direct the work for foremen and students; salary to be $1,000 per annum (nine months). (2) A man (black preferred) to teach the colored, iron working and forging, subordinate to the preceding; salary, $780. (3) A man (white) competent to take classes in engineering (assistant's position), but with the ability to perform any of the work required in any of the ordinary engineering courses of our universities; salary from $1,000 to $1,500. A. H. BEALS, Milledgeville, Ga.

ready been sold. The regular edition, in two volumes, will be ready on the 26th.

—J. B. Lippincott Co., Philadelphia, recently issued "The Tannins," by Henry Trimble. The author is professor of analytical chemistry in the Philadelphia College of Pharmacy. It is now about one hundred years since tannin first became recognized as a distinct substance. About twelve years ago the author commenced to collect the literature of the subject, especially that referring to the astringent value of certain tannin-bearing materials, with the methods involved in their estimation. As is always the case with one thoroughly interested in his subject, the work grew on Professor Trimble's hands till he thought best to give to the public a work on the general subject, with gallotannic acid, and an index to the literature, leaving for a subsequent volume the remaining individual tannins. It has been the author's constant endeavor to make the book more than a mere compilation, and the results of much of his own experience have, therefore, been incorporated. It is the author's hope that the present publication may lead others to aid in bringing together information on his subject.

—The American Book Company, New York, Cincinnati, and Chicago, has recently issued a "Laboratory Manual of Chemistry," by James E. Armstrong and James H. Norton. Mr. Armstrong is principal of Lake High School, Chicago; and Mr. Norton is principal of Lake View High School of the same city. The purpose of the manual is to aid the student in his laboratory work in such experiments as he can conduct himself, the experimental work to be supplemented by a course in some good text-book. We do not recall any other manual for use in chemical work in school laboratories which at all compares with the one now before us, and it seems to show that the interest in the best methods of scientific training in schools is making great progress.

SCIENCE

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SCIENCE

NEW YORK, APRIL 1, 1892.

STORAGE OF STORM-WATERS ON THE GREAT PLAINS.

SOMEWHAT exaggerated expectations have been aroused by the speculations of certain theorists in regard to the possibilities of water storage on the high, wind-swept, treeless plains lying between the 98th meridian and the Rocky Mountains. These visionaries have virtually promised every farmer a reservoir on his land if he would only make the effort to secure it.

The need of storage, if it can be made a success, is indisputable. Rivers are few, and, as a rule, inadequate to the irrigation of more than the lands of their own valley. Artesian wells are limited to certain sharply defined basins. Other wells are generally too deep for profitable irrigation by pumping, except for small plats of fruit and garden vegetables. If the mesas are to be extensively irrigated it must be by storage of storm-waters. Can it be done? If there is any doubt about it we would better know the truth than to encourage delusive hopes. Let us seek some quantitative numerical expression for the possibilities and limitations of storage.

The great robber of moisture on the plains is evaporation. The activity of the winds is so great and constant that more vapor is raised from exposed water surfaces than in many regions of greater heat. The annual evaporation is seldom, if ever, less than four feet, and may rise to eight feet. We may safely put the average as high as five feet.

The rain fall varies from one to two feet. Its seasonal distribution is favorable, the late spring months and the summer months receiving the greatest amount. So far as the quantity and seasonal distribution of the rainfall are concerned the chances of impounding some of it look encouraging. But it is not so much the aggregate of precipitation as the percentage of it which flows off on the surface, which determines the feasibility of storage. In a treeless region of great evaporation and porous soil and subsoil, the total run-off is always low, and much of that is subterranean. Humphreys and Abbott, in their report on the Mississippi River, estimate the total run-off of the Missouri valley at 15 per cent of the rain fall. This includes the springs which feed the rivers, as well as the superficial run-off. This subterranean factor is unusually large on the plains, because there are large areas on the mesas and among the sand hills, which have no surface streams. All moisture reaching the rivers from these areas percolates beneath the surface, and the superficial run-off is by so much diminished.

Again, if the average for the whole Missouri valley is 15 per cent of the rain fall, it is less than that on the plains, because the whole basin includes wooded areas and steep mountain slopes, from both of which the run-off is more than the average. If we reckon 7.5 per cent as the superficial run-off of the plains, that will certainly be as favorable as the considerations just presented will possibly admit. It is more likely to be too high than too low, for fully half, if not more, of the run-off is subterranean, and the total is less than 15 per cent, while we have allowed half of 15 per cent for surface flow which may be impounded.

The third important consideration is seepage. A reservoir may be made absolutely water-tight, but it is not likely to be. Rather is it absolutely certain that for small storage on the farm, executed without the aid of professional engineering, and under rigid conditions of economy, so that cementing, or puddling with clay, is out of the question on account of the expense, the loss by seepage will always be considerable. The possible variations of such loss are so great that we can do no better than to make a somewhat arbitrary assumption of its amount, say two feet annually. If the site is so badly selected, and the dam so poorly built, that the water will be lowered more than two feet annually by percolation, success is improbable; on the other hand, less than two feet would be too small a margin to allow for seepage under the circumstances. More would be fatal, and less is improbable.

The fourth consideration is the ratio of catchment basin to reservoir surface. This factor is more under human control than the others. At first blush it might be thought to be wholly a matter of choice. And so it is if the reservoir is artificially excavated. It may be dug deep and narrow to prevent evaporation. Its surface may be made only one-millionth of the catchment basin, if that is desirable. But the economy of water storage for irrigation will not admit of more excavation than that required to procure earth for the dam. Aside from the cost of digging it, a deep pit would require a pump to raise the water. Natural depressions must be utilized. But these are always broad and shallow on the uplands. Deep cañons and valleys are excluded because they are below the lands to be irrigated. They may answer for the valley lands below them, but not for the table-lands which we are considering. In the wide shallow basins of the uplands, if the waters have any considerable depth, they will spread abroad, cover much good land, and lose much by evaporation. But they must have considerable average depth throughout the year for two reasons. The maximum depth will occur after storms, the minimum during periods of drought. Unless the average is high it may readily happen that little or no water is available just when the crops need irrigation. Furthermore, the depth should be considerable, or else the reservoir will flood nearly as much land as can be irrigated from it. E. S. Nettleton, chief engineer of the Irrigation survey, U. S. Dept. of Agriculture, estimates that an annual average of nine inches of water over the whole surface of the field will be required for successful irrigation on the plains. One acre of reservoir with an annual average depth of four and one-half feet will therefore irrigate six acres of land. The value of the flooded land will absorb the profits of the operation if the ratio is greater than that, that is, if the depth of water is less.

It is evident that when water is impounded in natural depressions on the table-lands the reservoir will necessarily cover a considerable fraction of its catchment basin. Take

the proposition that every farm may have a reservoir, and see how it will figure out. For an average annual depth of four or five feet the water will spread over several acres, certainly not less than five acres. On a farm of 160 acres the catchment basin cannot be more than 32 times as large as the reservoir. Drawing from the lands of one's neighbors cannot be counted upon. Your neighbor below will be as likely to draw from your land as you are to draw from your neighbor above. The chances are even, and, in the general summing up of catchment areas, each can only count upon his own. Indeed he cannot count upon all of his own land, for, if it is all devoted to gathering and storing the water, where is the field to be irrigated? That must lie below the reservoir, as the catchment basin must lie above it. This simple matter of levels imposes another rigid limitation upon successful storage. Tillage of the catchment basin, causing greater absorption of the rainfall — possibly complete absorption of it — is another contingency which may defeat storage.

If the farmer owns a half section, 328 acres, and if we make due allowance for irrigated fields, and for slopes which face away from the reservoir, he may possibly get a ratio as high as 50:1. This is not enough for successful storage. On a section, 640 acres, it might be as high as 100:1, if the slopes were happily disposed. Instead, therefore, of a possible reservoir on every farm, it is clear that only very large farms having a favorable topography can enjoy this luxury. The ratio 100:1 probably represents the maximum of favorable conditions which can ordinarily be realized on the plains. Hence we need not consider the possible results of any higher ratio. Nor need we go below the ratio 50:1, since that is already below the requirements of successful storage.

It appears then that, instead of the ratio of catchment to the storage area being a matter of choice, it is subject to quite narrow limitations.

We set out to seek quantitative results. By using data given above for evaporation, run-off, and seepage, which are believed to be fairly good approximations to the actual values of those factors, we may construct[1] the following table: —

Table showing the annual average depth of water for ratios varying from 50:1 to 100:1, and for rainfall varying from one to two feet, the annual evaporation being five feet, seepage two feet, and the run-off 7.5 per cent.

Ratio of Catchment to Reservoir Surface.	Depth of Water for a Rainfall of				
	12 inches.	15 inches.	18 inches.	21 inches.	24 inches.
50:1	None.	None.	None.	None.	.5 ft.
60:1	"	"	"	.87 ft.	2. ft.
70.1	"	"	.87 ft.	2.19 ft.	3.5 ft.
80:1	"	.5 ft.	2. ft.	3.5 ft.	5. ft.
90:1	"	1.44 ft.	3.12 ft.	4.81 ft.	6.5 ft.
100:1	.5 ft.	2.37 ft.	4.25 ft.	6.13 ft.	8. ft.

This table must not be taken to mean more than was intended. "None" does not mean that a reservoir under the given conditions would not contain water at any time in the whole year. It might be full after a storm, yet the average expectation of finding water there at any date when it is needed for irrigation is correctly expressed by zero.

[1] The formula for computation is $\frac{R \times r \times r'}{100} - (e+s) = D$, in which R = rainfall, $\frac{r}{100}$ = run off, r' = ratio of basin to reservoir, e = evaporation, s = seepage, and D = annual average depth of water resulting from the given conditions.

The table is intended merely for a quantitative expression of results which will follow if the assumed data are fairly correct. And, if they are somewhat erroneous, whoever knows a more accurate value for any factor can readily insert it, and correct the table. Quantitative expressions, even when based upon assumptions and hypotheses, are more instructive than vague and speculative generalizations. This table, for instance, shows certain limitations of water storage so narrow and rigid that any errors which are likely to be detected in the assumed data will not overcome them.

To specify some of these limitations, take the first column of the table. It means unmistakably that no storage can be made from a rainfall of one foot. The highest ratio, that of 100:1, a ratio which can seldom be realized, gives only six inches as the permanent average depth of water in the reservoir. None of the assumed data can very well be so far astray that its correction will raise the amount to a reliable irrigation head of water. Possibly full at one time, but dry as a powder-horn at other times, such a reservoir would be useless, because it would be unreliable. Certainty — that most valuable feature of farming by irrigation as opposed to an enforced dependence upon the fickle goddess of weather in the rain-belt — would be lost. The farmer must have the water just when he needs it, not just when it happens to come. The figures for average annual depth show the maximum which can be relied upon with certainty at any given date. While it might sometimes be greater, there is no rational assurance of it.

The seasonal distribution of the rainfall is so far favorable to a speedy use of stored waters, without serious loss by evaporation, as to make the case somewhat better than appears in the table. But over against this is the neutralizing consideration that the greater rainfall of spring and summer is more fully absorbed than the lighter precipitation of winter upon frozen ground. Melting snows yield a greater run-off than summer rains. This increases the average period of storage before use, and correspondingly diminishes the chances of success.

These changes are still too slender to be at all reliable if the rainfall is fifteen inches. Indeed, it is not until we come to the column headed "18 inches" that we find any encouragement. One result at the bottom of that column looks hopeful, but that calls for a catchment surface one hundred times as large as the reservoir — a condition which, when coupled with the further limitation of enough good irrigable land under the reservoir, not one farm in a hundred can fulfil.

The promising figures are twice as numerous in the next column, and three times as numerous in the last. But even with two feet of rainfall the chances of failure and success are about even. The ratio must be at least 75:1, or a mean between the lowest and highest in the table.

For areas having a greater rainfall than two feet, where the impounded waters might be useful for other purposes, but would hardly be needed for irrigation, the possibilities of storage may be easily discovered by extending the table.

Water storage upon the high mesas of the treeless belt is, if not wholly a delusion, at least somewhat delusive. More hopeful is the expedient of deep tillage, which is also a sort of storage. Hidden from sun and winds in the loose soil and sub-soil, the moisture will thus be preserved at the very spot where it is needed to sustain vegetation.

L. E. HICKS.

DR. BAILLON'S "Dictionnaire de Botanique," the publication of which was commenced in 1869, is now completed.

THE SOPHISTICATED FRENCH WINES.

LOVERS of the glass that is alleged to exhilarate with moderation, and more especially those whose glances melt at the sight of French labels, will be interested in a report recently made to the French Academy of Science by three celebrated chemists. Our California vintners, too, whose machine-made wines by a chemical miracle become five years old within ten days from the press, will also find something to interest them. The report was made *apropos* of a question submitted by the Paris Chamber of Commerce whether it was permissible to use the salts of strontium to precipitate the excess of plaster added to wine by vintners. The question was referred by the Academy to a committee composed of MM. Berthelot, Duclaux, and Gautier. These eminent *savants* made the following report: —

"For above thirty years the employment of plaster in the manipulation of wines has been general throughout the south of France. A recent law has decreed that the maximum quantity of sulphate of potassium per litre in merchantable wine shall be two grams, and therefore the wine trade demands a method for reducing the quantity of sulphate in wines on hand to the legal limit. Some of these have already begun to use for this purpose a mixture of tartrate of strontium and tartaric acid. These substances added in the right proportion cause the precipitation of sulphate of strontium and the solution in the wine of bitartrate of potassium. This operation replaces in the wine the tartrate of potassium removed by the plaster, but unfortunately the wine also retains in solution more or less of tartrate of strontium. This salt is not a normal constituent of wine. It is not found in any foodstuff, though it exists in some mineral springs, as, for instance, those of Vichy. When pure, these salts are not believed to be poisonous in ordinary doses.

"The question submitted by the Chamber of Commerce includes in effect a question of principle and one of fact. In principle one might say that, wine being a natural product, the addition of any chemical substance whatever should be looked upon as a falsification, more especially is this the case when the purpose of the substance added is to mask the real character of the wine and deceive the purchaser as to the real nature of the merchandise he purchases.

"Moreover, it appears to the committee that to furnish the Chamber of Commerce with a method for deplastering wines will in effect throw the authority of the Academy in favor of plastering, and will, furthermore, seem to promise a further scheme for destrontianizing the wine, to use a neologism, and so on, *ad infinitum*.

"It is necessary to define clearly the point where wine ceases to be a natural product and becomes a chemical fabrication. It is to the interest of no one, either among the vintners or among the merchants, to furnish grounds for proclaiming to the world that French wines are artificial products made, not by vintners, but by chemists. The authority of the Academy cannot be used for any such purpose. So much for the question of principle; now as to the facts: Though strontium may not be a poison in ordinary doses, and even though it may serve as a useful medicine in certain cases, it is by no means certain that when used in sensible doses, as it must be if it becomes a constituent of an alimentary substance in such common use as wine, it will be without effect upon the bodily functions. It is necessary to be not merely prudent but even timid in deciding whether or not to introduce into the bodily circulation mineral elements which normally do not exist there. Such substances, even when apparently innoxious at first, may by their accumulation in the body produce at length very grave consequences. What may be innoxious to some persons may be ruinous to others, according to temperament or pre-existing maladies. The experiments of M. Soborde have shown that tartrate of strontium may produce congestion of the kidney in animals. Still, further, it must be remembered that therapeutic experiments with strontium have been conducted with a chemically pure salt. The strontium of commerce is always more or less mixed with salts of baryta, which are not easily separated, and which are very poisonous. The danger would be very great were these salts to become articles of ordinary commerce, to be used without discrimination or control by vintners and wine merchants. These would buy their supplies in the cheapest markets without regard to purity. We know, too, how difficult it is to use such substances in such exact proportions as to get just the desired reaction among the elements employed.

"For these reasons the committee recommends that the Academy reply to the Chamber of Commerce that it declines to approve of the employment of salts of strontium for deplastering wines, and reprobates such practices."

At a subsequent sitting of the Academy M. Quontin contributed the result of a study of deplastered wines. The process of deplastering is used only for the purpose of reducing the contents of the wine in potassium sulphate to the legal limit. M. Quontin found in the course of his researches that not only are the chloride, nitrate, and carbonate of baryta commonly used, but also that the tartrate, acetate, and phosphate are employed for this purpose.

M. Berthelot, in discussing M. Quontin's paper, said that the facts brought to light by M. Quontin's researches bore a character of very grave interest. The deplastering of wines by means of the salts of baryta was not merely a method of falsification of a common alimentary substance, but a real, wholesale manufacture of poisons.

GERALD MCCARTHY.

North Carolina Experiment Station.

A BOTANICAL LABORATORY.

FORMERLY the botanical laboratories were given up almost entirely to systematic and structural work, this being as much a matter of necessity as of choice, for the physiological and bacteriological work are comparatively new branches of the science of botany, requiring specially designed apparatus, which is often very costly. Of late years, however, the great scientific and economic value of the latter subjects is being realized, and laboratories are being equipped in which these lines can be pursued.

One of the finely furnished physiological and bacteriological laboratories of this country is that at Purdue University Experiment Station, La Fayette, Ind., equipped by Dr. J. C. Arthur. The laboratory consists of five rooms beside the greenhouse, these being a general laboratory in the centre, a library and herbarium to the west, a bacteriological room to the east, and a store-room and dark room to the north. The general laboratory has a large window, occupying nearly the whole width of the south side of the room, furnished with light lower curtains and a dark heavy upper one. These can be adjusted so as to tone the light on a bright sunny day, and allow the entrance of all the light possible on a gloomy day. In front of the window is a long table fastened to the wall to prevent vibration as much as possible; this is used for microscopic work. The walls are lined with wall cases and cases of drawers for reagents,

glass-ware, and apparatus in immediate use. There are tables with gas and water supply; a sink with hot water apparatus and cleated shelves for drying purposes; and drying and constant-temperature ovens. Accompanying the reagent case is a card catalogue, which indicates very nearly the arrrngement of reagents, so that the time taken to find one is reduced to the minimum.

Among the pieces of apparatus in the room are auxanometers, clinostats, electric and mercuric thermo-regulators, hot stages, dialyzers, pressure regulators, chemical, torsion, and ordinary balances, dynamometers, an electric motor, transpiration tubes, etc.

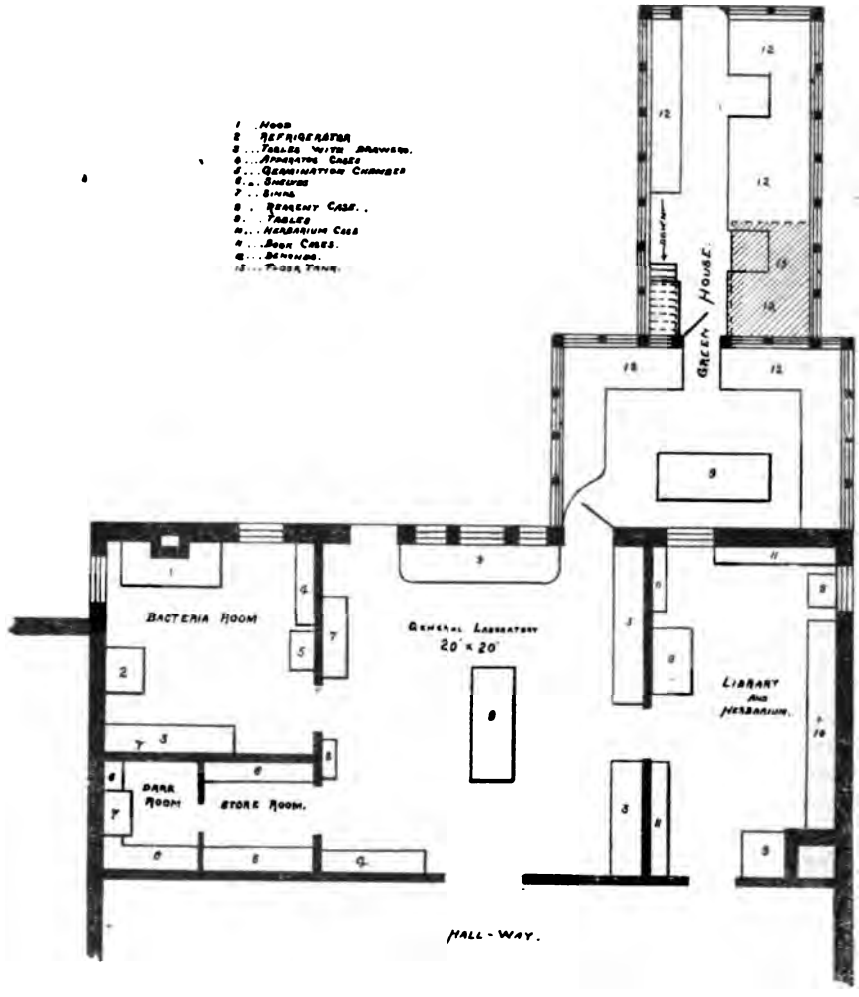
The bacteriological room has a south and east light, and is fitted up with the latest appliances; such as steam and dry-air sterilizers, germination ovens, bulb and ordinary culture tubes, and all the various paraphernalia used in bacteriological work. There is a large table with sink, having a water supply, and cases of drawers for supplies of cotton, agar, gelatine, cages, etc., a case of stains, and a large hood with water supply in which the steam sterilizers are placed.

The library and herbarium on the opposite side of the general laboratory to the bacteriological room contains the standard works, and as Dr. Arthur's private library is kept here besides, there are many valuable and rare works to which one does not usually have the good fortune to have access. There is also a good supply of botanical journals both in English and foreign languages. The library is specially well supplied with works on plant diseases, parasitic fungi, and physiological subjects. The library is carefully catalogued.

The herbarium contains both phanerogams and cryptogams, parasitic fungi being specially well represented.

In the store room are kept the supplies not in immediate use. Leading from the store-room is the dark room for photographic work; this room being supplied with gas, water, a specially arranged sink, and the chemicals and appliances needed in the work.

A small greenhouse extends south from the station, its main room opening directly from the laboratory and on the same level. This room is fitted up with tables and benches upon which apparatus can be placed when the student is working with the living plants. The smaller room is on a lower level, and is kept at a lower temperature than the main room. Experiments can thus be carried on with plants at different temperatures. There are also in this room a floor tank for aquatic plants, and steam-heated cutting beds. Both rooms are heated by steam. The greenhouse forms a very useful adjunct to the laboratory.



The laboratory in the Station is entirely separate from the University laboratory, the latter being under the direction of Dr. Stanley Coulter; the work there is in systematic and structural botany. The students in Dr. Arthur's laboratory who do the physiological and bacteriological work are juniors and seniors who have elected botany and have done the systematic and structural work previously. There are also post-graduate students who are doing original work.

KATHERINE E. GOLDEN.

THE DISTRIBUTION OF FISHES.

A GOOD illustration of the amount of change brought about by deep-sea investigations in our ideas of the distribution of the fishes is to be seen in the recent history of the Discoboli. A short time ago it was supposed all the representatives of this group — the Discoboles, disk-bearers, lump-fishes, sucking-fishes, or sea-snails, as they are variously called — were restricted to the Atlantic and Pacific, in their northern parts, and to the Arctic Ocean. This was previous to 1870. At that date species were known of each of the families of the group. From the Atlantic section there were two species of the Cyclopteridæ — Cyclopterus lumpus and Eumicrotremus spinosus — and five species of the Liparididæ — Liparis montagui, L. liparis, L. tunicatus, Careproctus major, and C. Reinhardi. And from the Pacific the list contained one species of the Cyclopteridæ, Eumicrotremus orbis, two species of the Liparopsidæ, Cyclopterichthys ventricosus and Liparops stelleri, and five species of the Liparididæ — Liparis mucosus, L. calliodon, L. Agassizii, L. pulchellus, and Careproctus gelatinosus.

Between 1870 and 1891 the additions from the Atlantic were four species of the Liparididæ — Careproctus micropus, Paraliparis bathybius, P. liparinus, P. membranaceus. In this period the northern Pacific had yielded one species of the same family, Paraliparis rosaceus. But the more important additions in this time were from the southern end of the American continent, whence came one species of the Liparopsidæ, Cyclopterichthys amissus, and three species of Liparididæ—Liparis antarctica, L. Steineni, and L. pallidus (one or more of which may yet prove to be young of Careproctus). Previous to 1891 this was the state of our knowledge of the Discoboles; and the generally accepted idea of their distribution limited them to the far-north and to the far-south, and displaced them in the tropics by other disk-bearers belonging to very distinct families, the Gobiidæ and the Gobiesocidæ. As such a number of the Discoboli were deep-sea forms, and as the anatomy in general was that of types adapted to a life far below the surface in low temperatures, there seemed to be no reason for supposing them absent from great depths under the torrid zone. These considerations induced me, in monographing the group for this museum, to predict that eventually the proper distribution would be found to extend from the northern to the most southern localities on the sea bottom (Mem. Mus. Comp. Zool., XIV., No. 2).

Since 1890 a new genus, Cyclopteroides, and new species have been added to the number of Discoboles known from the North Pacific. They, however, did not affect the distribution previously determined. It remained for the United States Fishery Commission steamer "Albatross," under Commander Tanner, to supply what was needed to verify the prediction. Among the fishes collected by this vessel while dredging off the west coast of Central America, in charge of Professor Alexander Agassiz, I find representatives of two species which place the sub-equatorial distribution beyond question. These specimens were secured within four degrees of the equator, at depths of more than 1,700 fathoms, in temperatures of about 36° F. They are figured and described in the forthcoming report on the fishes of these explorations, under the names Careproctus longifilis and Paraliparis fimbriatus. By their capture the Artarctic are connected with the Arctic localities, and the range of the Discoboli is proved to be one of the most extensive among the fishes, though the affinities and habits of those we now know are such as indicate that the present list of the species lacks much of being complete.

But the modifications of our ideas by deep-sea exploration, as will be shown in a later writing, are not confined to a particular group. Our conclusions respecting numbers of the families with which we had supposed ourselves well acquainted have been affected directly, through new species and extended ranges, and indirectly, through peculiarities of anatomical or other relationships that appear as evidences of the existence of allied forms not yet known, and of yet to be discovered centres of distribution serving as sources of replenishment for the fisheries, retreats for recovery from depletion, or as possible new grounds for our fishermen.

S. GARMAN.

Museum of Comparative Zoology, Cambridge, Mass., Mar. 7.

NOTES AND NEWS.

A NEW "Jahrbuch der Chemie" is to be issued by the German publisher, H. Bechhold, Frankfort. It will be edited by Professor R. Meyer, who has secured the co-operation of many eminent men of science. The intention is that the progress of pure and applied chemistry shall be recorded every year in a connected series of articles.

— Japan has no fewer than 700 earthquake-observing stations scattered over the Empire, and the Tokio correspondent of the London *Times* is of opinion that they are all needed. He points out that not only are the Japanese shaken up by fully 500 earthquakes every year — some of them more or less destructive — but at intervals there comes a great disaster, amounting, as in the earthquake of Oct. 28, 1891, to a national calamity. Japanese annals record twenty-nine such during the last 1,200 years.

— The volcano of Kilauea is very active at present. The cavity produced by the last breakdown has not filled up, but there is an active lake two or three hundred feet below the general level of the floor and a quarter of a mile in diameter. Rev. S. E. Bishop of Honolulu says the whole plateau of Halemanman is steadily rising. It is evidently being pushed up by lava working underneath and not built up by overflows. Professor W. D. Alexander, in charge of the Trigonometrical Survey, writes that his assistant, Mr. Dodge, will probably re-survey the crater during the coming summer, for the purpose of comparing the present topography with that delineated in *Science*, vol. ix., p. 181, 1887. The Volcano Company is constantly improving the facilities offered to visitors for inspecting the crater.

— It sometimes happens that peat bogs swell and burst, giving out a stream of dark mud. Herr Klinge, as we learn from *Nature*, has made a study of this rare phenomenon (*Bot. Jahrb.*), of which he has found only nine instances in Europe between 1745 and 1883 (seven of these being in Ireland). Heavy rains generally occur before the phenomenon, and detonations and earth vibrations precede and accompany it. The muddy stream which issues, of various fluidity, rolls along lumps of peat, and moves now more quickly, now more slowly. After the outbreak, the mud quickly hardens, and the bog sinks at the place it appeared, forming a funnel-shaped pool. The bogs considered by Herr Klinge have been almost all on high ground, not in valleys. He rejects the idea that the effects are due to excessive absorption of water by the bog. The peat layers, which often vary much in consistency, have each a certain power of imbibition, and the water absorbed does not exceed this limit. Excessive rain affects chiefly the upper layer not yet turned into peat and the cover of live vegetation, which gets saturated like a sponge, after which the water collects in pools, and runs off in streams. The theory of gas explosions is also rejected; and the author considers the real cause to lie in landslips, collapses, etc., of ground under the bog, permitting water or liquid mud to enter. This breaks up the bog mechanically, mixes with it and fluidifies it, and an outburst at the surface is the result. The limestone formations in Ireland, with their large caverns and masses of water, are naturally subject to those collapses, which, with the vibrations they induce, are more frequent in wet years. The heavy rains preceding the bog eruptions are thus to be regarded as only an indirect cause of these.

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THE PATENT OFFICE BUILDING.

WE have recently referred to the condition of the United States Patent Office as revealed by the reports made at the meetings of the Association of Inventors and Manufactures. It will be remembered that it was stated that either a new and much larger building is required for the work of that department of the Government, or a great extension of the present building and quarters. Every commissioner of patents for many years past has endeavored to bring this matter before Congress in such manner as to secure some relief, but without avail; and the condition of things in the building has now become, in consequence of the supineness of those responsible for it, as testified by the speakers in the discussion in the Senate reported in part below, something shameful and almost indescribable. It will be remembered also that the Patent Office building was erected many years ago, and especially for its present uses, at a cost of about $3,000,000, all furnished by the inventors of the country; but it is now so utterly inadequate to its work that clerks and other officers in the office are actually in danger of asphyxiation. But this is not all; this building, built with the money of inventors thus taxed for the privilege of making this country the most prosperous and wealthy on the globe, money contributed by poor inventors usually, is not now even permitted to be appropriated to the use for which it was constructed or the purpose to which it was dedicated; but the Interior Department, organized since the formation of the Patent Office, has been permitted to enter its "camel's nose" into this tent, and has now succeeded in getting so much of its body in that it actually dispossesses the rightful proprietors, and it has even been suggested by at least one secretary of the interior that the Patent Office be dispossessed entirely.

The Patent Office rightfully owns the building, which is paid for out of its own earnings at a cost of $3,000,000, and the accumulations of inventors' money in the treasury amount to about $4,000,000 more; nevertheless, it seems next to impossible to save the business of the country from further serious expense and enormous embarrassment through delayed cases, or to preserve the employees of the government from danger to health and life by the construction of a new building which might be, and should be, immediately constructed. It seems unfortunate enough that the present state of affairs should exist; but it seems doubly so when it is considered that poor inventors taxed for the benefit of a country which they have done so much to aid are not permitted to even build for themselves a building in which their work can be carried on in a business-like way, promptly and efficiently and at their expense. We quote from the *Washington Star*:—

"There was an interesting debate on local public buildings in the Senate yesterday afternoon. Senator Carey offered a resolution, which was printed in *The Star*, in which the committee on public buildings and grounds was called upon to report upon the condition of government buildings, the necessity for new buildings, the probable cost of the latter and the amount now annually spent for rent by the government.

"Senator Allison stated the rental expenditure as about $140,000 per annum. He did not object to the inquiry, but he thought it would do very little good. Everybody knew that public buildings were needed.

"Senator Hawley made several pertinent and forceful remarks as to the structurally dangerous and generally unhealthy condition of the government printing office.

"Senator Platt talked pointedly of the Patent Office. Said he: 'It is now at least eight years since I called the attention of the Senate to this matter. The difficulty has been increasing ever since. Although we have been taking business out of what is known as the Interior Department building, the danger, the overcrowding, the unhealthiness of that building have been increasing all the time, notwithstanding the room that has been made for the Patent Office. I said then, and I repeat now, that if there was a factory in the State of Connecticut where the employes were obliged to work under as unfavorable conditions as to health as the clerks in the Patent Office, the proprietors would be prosecuted and convicted under the laws of the State of Connecticut.'

"Senator Gray had been looking into the matter also. 'I had occasion,' said he, 'as a member of the committee on patents of this body, to visit the portion of the Patent Office building to which are assigned the documents and records which have made the tremendous weight that is jeopardizing the safety of that building, and though I expected to find some inconvenience there and a state of things which was very undesirable, I was not prepared to see what was exhibited to me, and I have felt ever since that there was a personal responsibility resting upon every member of this body and upon the co-ordinate body of Congress as long as that state of thing continues for the lives as well as for the health of those people who are compelled to labor there for their daily sustenance. I found a room there in which seventy or eighty ladies were performing their clerical duties that was so stifling that a half-hour's visit to that room made me so glad to get into the fresh air that I should be very unwilling to go back there again and stay the same length of time.

"'While we are waiting for the fire-proof building referred to, there is danger that some of these people may be asphyxiated in the interval, and I think, among all of the important

questions that are pressing upon the attention of Congress, there is none more important and exigent than attention to this matter which has been brought up by the senator from Connecticut. I do not believe we can afford to wait a single day in giving our attention to some method of relief. I understand from the report made by the secretary of the interior that the quantity of air to each individual in the part of the building where these ladies worked is about 400 cubic feet, whereas Dr. Billings, the best authority perhaps in the United States or in the world on sanitary matters of this kind, says that human life cannot be healthfully continued without something like 4,000 cubic feet to the individual. I asked the gentleman who has charge of that room how they managed to get along at all, and he said that at intervals of about two hours or an hour and a half they had to ask all these people to go out of the room — in winter time, of course — so that they might raise the windows in order to change the air; otherwise they could not get along as well as they do. That condition of things is shameful as well as deplorable, and I think some action ought to be taken at once in the interest of the human beings who are compelled by their necessities to perform their duties under such circumstances.'"

THE STRUCTURE OF THE HEMIPTEROUS MOUTH.

OUR knowledge of the mouth parts of the Hemiptera is given by Professor Comstock in his valuable "Introduction" as follows: "The mouth parts are formed for piercing and sucking. Without dissection they usually appear as a slender, jointed beak, arising at the base of a shorter, pointed labrum. This beak consists of four bristles inclosed in a fleshy jointed sheath. Two of the bristles represent the

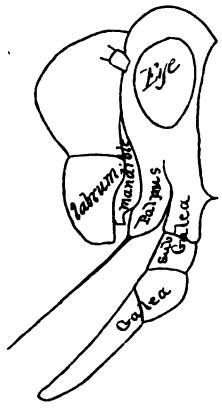

FIG. 1.

mandibles and two the maxillæ. The sheath is supposed to consist of the labium and grown-together labial palpi. This sheath is usually four jointed, and is never composed of more than that number of segments. The maxillary palpi are wanting." The results of my studies in the Diptera, Hymenoptera and on the pupa of Cicada, lead me to disagree with this explanation, or homology, of the parts.

The head of a Cicada pupa when softened and cleaned so that all the parts are easily recognizable, shows four divisions, or sclerites, forming the lateral margin of the head inferiorly. In Fig. 1 the sclerites are shown, pried apart for convenience of recognition, and without attempt at any but diagrammatic result. The anterior of the sclerites is the labrum, covering the base of the mouth, and normally appressed so close to the beak that the intervening structures are not visible. Behind the labrum and normally closely united to it is the mandibular sclerite, which has not been heretofore recognized, but which is exactly where it should be, compared with a mandibulate mouth. From the side this sclerite gives a mere indication of its character and from the firmness of the union shows that the mandibles are not mobile and therefore not functional. Cutting along the posterior suture of the mandible and then straight across so as to get

FIG. 2.

the whole of the labrum, we get from behind the view shown in Fig. 2. Here the mandibles show as elongated flattened strips, quite chitinous in texture toward the tips, which latter are acute and somewhat beak-like, divergent. The extremities lie so close to the pointed tip of the labrum that they are invisible from the side. In the cavity between the mandibular sclerite and the front of the labrum there is at least one large gland, probably that secreting the irritating fluid which many bugs inject into the punctures made by the beak. From this gland a distinct duct leads to the pointed

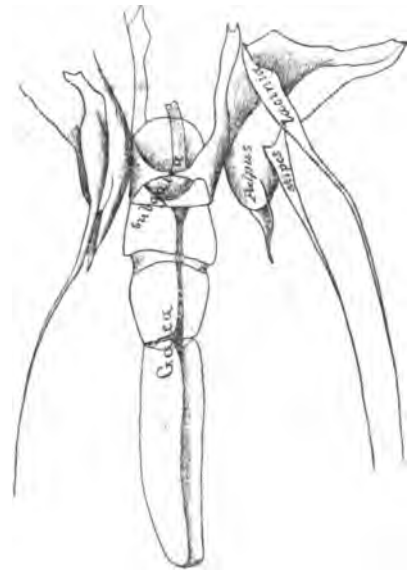

FIG. 3.

tip of the labrum behind and between two chitinous wings giving muscular attachments. In *Belostoma* the labrum is extended so as to cover the beak for half its length. Here there is a salivary gland behind the clypeus, the duct extending to the tip of the labrum and then apparently discharging into the beak. In some species the labrum is set inwardly with a coating of very fine, dense hair, giving a velvety surface, and this, as Dr. Packard has shown is the epipharynx. It is not present in the Cicada pupa. The sclerite next behind the manibular ring is that from which arise the two bristles that are usually homologized with the mandible and

maxilla. That neither of them can be mandible follows from the fact that I have already demonstrated the true mandible. Removing the front rings altogether and spreading out flat the two posterior sclerites after removing the internal structures, we have the appearance shown in Fig. 3. In this figure we see the intimate connection between the beak and the maxillary structures. The two bristles are seen to arise from one base, and attached to the same source is the remnant of the maxillary palpus. The organ is much reduced, and probably not functional; but there is no doubt of its nature. By the pressure applied the base of the bristles is torn from the fastenings, which are distorted out of recognition. Figs. 4 and 5 give the true appearance. These two

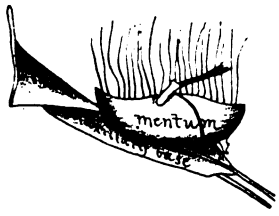

FIG. 4.

bristles represent the lacinia and stipes of the maxilla, developed in exactly the same way in which they are seen in the Diptera. In most species they are quite strongly modified at the tip and there is a permanent distinction in the character of the armature of the two bristles which will be of assistance ultimately in distinguishing the parts.

The remaining maxillary part, the galea, I identify with the beak, denying thus its character as labium and grown-together labial palpi. No one has questioned the fact that the beak in the Hemiptera is the homologue of the similar structure in Diptera, and this I have shown is a galear development. The steps in the development are clearly shown by studying a series of the long-tongued Hymenoptera in connection with the piercing Diptera including Erax and allies.

FIG. 5.

Exactly how the change to the normal Hemipterous structure occurred, I have not yet been able to ascertain. In this view the basal segment of the beak through which it is attached to the other maxillary parts, represents the cardo; the second joint the subgalea; while the third and fourth represent the two joints of the galea. In the apparently three-jointed beak the basal segment is so intimately connected with the head that it seems to form a part of it. Dissecting away all tissue from the head and leaving only the cardo of the maxilla and the other internal mouth structures attached thereto, we have the appearance from behind shown in Fig. 5. Centrally there is a boat-shaped structure, on either side of which there is a flat chitinous plate with two leaf-like membranous processes attached. On each side of this central plate, and imbedded in the tissue, is one of the lancets. Seen from the side, as in Fig. 4, the boat-like form of the central organ is more obvious as are also the maxillary base and the lancets issuing therefrom. This boat is formed of two parts closely united along a suture which is parallel to the line of the suture separating the labrum, the anterior portion belonging in the cavity behind the labrum, the remainder belonging to the central head cavity. That portion of the process belonging in the frontal portion of the head is shown in Fig. 2 superiorly. Through the centre of this boat on the inside is a thin membranous plate, longitudinally furrowed in its centre, and from this central furrow sending up long flat filaments, the nature of which I have not recognized. This boat-shaped process I homologize with the mentum in mandibulate insects, the fulcrum of the Diptera. It is all that remains of the labium or second maxilla, if my interpretation of the structures is correct. Exactly at what point in the development the missing structures were lost, I cannot yet say; it will require close study in groups in which I have as yet no material at all. I am confident, however, that the above explanation of the homology of the structures will prove the true one.

JOHN B. SMITH.

Rutgers College, N. Y.

THE ETYMOLOGY OF THE TWO IROQUOIAN COMPOUND STEMS, -SKĚ^{N}-RA-KEQ'-TE' AND -NDUTA-KEQ'-TE'.

STUDENTS of Iroquoian terms have made attempts to analyze these two interesting compound-stems, but in making these analyses they overlooked the force and exact meaning of the component elements of these two stems, and so the etymologies they have put forth are erroneous. Too much weight was given to so-called "accepted authority," and indiscriminating compilation took the place of careful research.

It appears from the evidence of language that hitherto all students who have attempted to analyze these two compound terms have been misled by a mistranslation of the noun *Gaskenra*, made by Father Bruyas in his work mentioned below.

The writer will here cite what has been written by him upon the two stems in question as well as what has been written upon them by other authors who have had access to his writings. This is done for the purpose of showing to what extent Bruyas's erroneous translation has been an embarrassment to all his copyists; for they invariably quote his wrong definition of the noun in question, and yet make remarks, the reasons for which should have led them to the true etymology and signification of the elements and terms in question.

Father Bruyas[1] succinctly says, "*Gaskenra*, la Guerre. Inde *hoskenragetete*. S. 2ae conj. soldat." Again, on page 83 of the same work, he writes, "*Onn8ta*, coton, duvet." And immediately below this, "*Nond8tage°te*, la Guèrre. *Hotinnond8tagetete*, les soldats."

Father Cuoq, following his predecessors in Iroquoian glottology, writes,[2] "*Oskenra*, vieux mot qui n'est plus guère usité qu'en cp. avec le v. wakkehte, porter. Il devait signifier la *guerre* ou plutot qq. instrument de guerre. Roskenrakehte, au pl., rotiskenrakehte, homme de guerre, guerrier, militaire, homme portant armes." This citation may be translated thus: "*Oskenra* [is] an old word which is not much in use now except in composition with the verb *wak-*

[1] "Radices Verborum Iroquæorum," Neo-Eboraci, 1863, p. 98.

[2] "Lexique de la Langue Iroquise," Montreal, 1882, p. 36.

kehte, to carry. It must have signified war, or rather some instrument of war. *Roskenrakehte*, *rotiskenrakehte* in the plural, a soldier, warrior, martial man, man bearing arms." Again, on page 35 of the same work, we find, "*Onota*, jonc," i.e., *Onota*, "a rush or reed," being the *onn8ta* of Father Bruyas.

Following M. Cuoq, Mr. Horatio Hale says,[1] "*Oskenra* is an ancient word for war. *Kakehte* is to carry. The compound word, *roskenrakehte*, means 'one who carries on war.'"

Lafitau, although clearly pointing out the true origin of the two compound stems in question, fails to deduce from it the exact etymology of either stem. He was evidently misled by the mistranslation of *gaskenra* by la guerre, war, made by Father Bruyas, as cited hereinbefore, for *ka-skẽⁿ'-ra'* does not signify war. Before making an analysis of the terms at issue, the writer will here quote at length what Lafitau has written upon them. He says,[2] "Les Iroquois et les Hurons, nomment la Guerre *n'Ondoutagette* et *Gaskenrhagette*. Le verbe final *Gagetton*, qui se trouve dans la composition de ces deux mots, et qui signifie Porter, marque bien qu'on y portoit quelque chose autrefois, qui en étoit tellement le symbole, qu'elle en avoit pris sa denomination. Le terme *Ondouta*, signifie, le duvet qu'on tire de l'épy des Roseaux de Marais, et signifie aussi la plante toute entiere, dont ils se servent pour faire les nattes sur quoi ils couchent, de sorte qu'il y a apparence qu'ils avoient affecté ce terme pour la Guerre, parce que chaque Guerrier portoit avec soy sa natte dans ces sortes d'expeditions. En effet la natte est encore aujourd'huy le symbole qu'ils representent dans leurs peintures Hieroglyphiques pour dẽsigner le nombre de leurs campagnes. Pour ce qui est du terme *Gaskenrha*, il est si ancien que les Sauvages eux-mêmes n'en sçavent plus la signification. Mais comme il seroit inutile de courir après des étymologiès, sur lesquelles les naturels du païs sont embarrassés eux-mêmes, il me suffit de dire, que tout ce que les Sauvages portent dans leurs courses militaires, se reduit à leurs armes, à quelques ustenciles necessaires dans les campemens, et à quelques provisions de farine preparées de la maniere, dont je l'ai expliqué." This quotation may be rendered thus: "The Iroquois and the Hurons call war *n'Ondoutagette* and *Gaskenrhagette*. The final verb *Gagetton*, which is found in the composition of these two words, and which signifies to bear or to carry, shows, verily, that heretofore something was borne to it [i.e., to war] which was a symbol of it [i.e., of war] to such a degree that it [war] had assumed its [the symbol's] designation. The term *Ondouta* signifies the down [the wool-like substance] which is taken from the ear [cat-tails] of marsh-reeds, and it also denotes the entire plant, which they use in making the mattresses (nattes) upon which they lie, so that it appears that they applied this term to war, because every warrior, in this kind of expeditions, carried with him his own mattress. In fact, the mattress is still to-day the symbol employed in their hieroglyphic picture-writing to denote the number of their campaigns. As to the term *Gaskenrha*, it is so old that the Savages themselves no longer know its meaning. But as it would be profitless to run after etymologies concerning which the natives of the country themselves are perplexed, it suffices me to say that the entire equipage of the savages in their military expeditions consists of their arms, of some necessary utensils for the encampment, and of some provision of meal prepared in the manner which I have explained." Again, on page 46 of the same Tome, while discussing the monogrammatic or hieroglyphic picture-writing of the Indians, Lafitau says, "Le nombre des expeditions est designé par des nattes. On distingue celles où il s'est trouvé, et celles où il a commandé, en ce que ces dernieres sont marquées par des colliers attachés à la natte." This citation may be rendered thus: "The number of expeditions is denoted by mats or mattresses (des nattes). There is a distinction made between those wherein one was merely a member and those wherein he commanded, in this, that the latter are designated by having wampum-strings attached to them."

It is only by a figure of speech,—by metaphor,—that either one of the compound stems, *n'Ondoutagette* or *Gaskenrhagette*, signifies war or warfare, for neither of the component nouns of the two stems is denotive of war, nor does the verb-stem with which they are compounded signify warring or to make war.

In the following lines, the alphabet used in the orthography of the Iroquoian terms and stems, other than those quoted, is that of the Bureau of Ethnology, Smithsonian Institution.

The verb-stem *-keq-te'*, although having the form of the perfect tense of a simple verb, the present tense form of which is now not in use (being no longer a living form of the verb), has the force and meaning of a present tense; and it is for this reason that its personal or pronominal affixes are those of the perfect tense of regular verbs. It has a specific meaning only; namely, to bear or rather bearing [something] on the back [by means of the forehead strap]. Hence, for the purposes of etymology, to translate it simply by such general terms as "to bear," "to carry," and "to carry on," is a mere waste of time and a confession of the ignoring of its only and specific meaning which requires its composition with such nouns of things only which may be borne on the back. Indeed, the name of the forehead-strap, *ka-keq'-ta'*, is derived directly from it, the initial *ka-* being only a gender sign, and the final *-a'* a nominal formative.

In the compound stem *n'Ondoutagette*, cited by Lafitau, the initial *n* and apostrophe are used for the definitive *ne* pronounced as a proclitic. The noun in it is *on-dú'-ta'* (Ondouta), which signified a reed or rush, the material for mat and mattress-making; the down, or cotton, of reeds, rushes, and plants; and, lastly, the war-mattress or war-mat.

To confirm what has been advanced in support of the writer's definition of the word *on-dú'-ta'*, he will cite what is found in the "Huron Grammar" of Père Pierre Potier, dated about 1750. Therein are to be found the following entries, "*kandõta*, jonc à nattes," i.e., reed or rush for mats; again, under "Meubles d'une Maison," is to be found "*ondõta*, natte de guerre, i.e., war-mat or war-mattress. This is conclusive evidence as to the early meaning of *on-dú'-ta'* as pertaining to warfare. Hence, *on-du-ta-keq'-ta'*, the participial form, signifies, etymologically, "bearing a war-mat or mattress on the back." Replacing the initial gender-sign *o-* by the masculine pronoun of the singular third person of the anthropic gender, *ho-*, he, we have *hon-du-ta-keq'-te'*, "he bears a war-mattress on the back," which was one of the customs of warriors on the war-path.

It has been said elsewhere in this article that *ka ske^{n}'-ra'* (Gaskenrha) did not mean warring or warfare. Lafitau states, in the citation from his work above quoted, that, in his time, its meaning was unknown to the Indians themselves. But, misled by Bruyas's mistranslation of it, he

[1] "Transactions of the Buffalo Historial Society," vol. 3, p. 72.

[2] "Mœurs des Sauvages Ameriquains, Comparées aux Mœurs des Premiers Temps," Tome I^{e}., 191-5 pp. Paris, 1724.

doubtless asked them if the word meant war, and, receiving a negative reply, he at once inferred that as it must be an archaic word for war its signification had been forgotten by the Indians; for was it not still the component element in a compound meaning war and warrior? This inference, however, was erroneous.

Since it is compounded with the verb-stem *-keq-te'*, it must like *on du'-ta'* signify something which had to be borne on the back by the warrior. Under the heading, "Meubles, mesnages, outils," i. e., "Family or household goods, tools, etc.," Fr. Gabriel Sagard, in his "Dictionnaire de la Langue Huronne" (1632), wrote "Ballet, *Oscoera.*" In the fifth edition of the "Dictionnaire de l'Academie Francoise," Paris, 1825, there are two forms of the word "ballet" given; one of these is "balle," signifying a large pack of goods, bound with cords, and wrapped in coarse linen cloth, and the other is "ballot," meaning a large pack or bundle of family or household goods. The word bale is evidently the correct rendering of this word. But it is very improbable that a bale as such formed a part of the family and household goods and tools of the early Hurons. It is likely, however, that *oscoera* signified a mat woven from the common Indian hemp (Apocynum Cannabinum), and thus merely a form of the modern Mohawk, and perhaps proethnic, *oska'ra'*, flax, hemp, tow, the Tuskarora form of which is *u'-ska-rĕ*, meaning shawl, blanket, bedding, bed-cover, whatever is spread to lie upon; being found in *yä-çka-re^{n}'-kua'*, "one uses it to spread," which is a descriptive name of a carpet. Father Bruyas (on page 115, op. cit.) has "*Gentskaron*, estendre, mettre la natte," i. e., to spread or lay the mat or mattress; and "*Gentskare*, S. natte, avoir une natte," i. e., a mat, to have a mat, mattress. Père Pierre Potier (op. cit.) has "*kaskara*, tout ce qui sert à coucher," i. e., all that which is used for bedding. It is thus seen that the noun-stem *-skar-* has the same meanings that *-ndut-*, the stem of *on-du'-ta'* has, but it has a wider application in the modern vocabulary. There is no attempt made here to connect these stems etymologically, but a similar sematologic development only is shown in the two stems.

The stem of *ka ske^{n}'ra'* is *-ske^{n}'-r-* or better *-ske^{n}'r-*. In the stems *-skar-* and *-ske^{n}'r*, we have two generic noun stems, having the same consonnatic sounds, sustaining one to the other the same positions in the two stems respectively, but differing in the interconsonantic vowel which vocalizes them. Nevertheless, it is assumed that these two stems are derived from one and the same proethnic source. It is clear that the stem *-skar-* is the older form, in that it is the simpler of the two. The change of the mid-stem vowel *a* to *e^{n}* is explained by the presence of the "interrupted explosive," represented by an apostrophe before a following *r* and by the presence of a *k* immediately before the vowel changed. The cause of the change was the "interrupted explosive," which became a part of the stem by analogic metathesis, a procedure which is not unknown in this language. So that there exists no formidable phonetic difficulty in the way of regarding the two stems *-skar-* and *-ske^{n}'r-* as derivatives from one and the same proethnic form, having the meanings possessed by the stem *-skar-*, already given above. Thus, it appears that *ka-ske^{n}'ra'* meant a mat or mattress; and this is the meaning which is absolutely required by the verb stem *-keq-te'* with which it is compounded.

Thus, both the compound-stems *-ske^{n}'-ra keq-te'* and *-ndu-ta-keq'-te'* were denotive of a custom of the Iroquoian warrior when on the war-path. The pronominal prefixes have been suppressed for brevity's sake. Prefixing the pronoun of the third person masculine singular of the anthropic gender, *ro-*, to the first, we have *ro-ske^{n}'-ra-keq'-te'*, "he bears a mat on the back;" and *ho-*, a dialectic form of *ro*, to the other we have *ho ndu-ta-keq'-te'*, he "bears a mat on the back." So that in the baldest English a warrior was a "mat — or mattress — bearer," in the tongues of the Iroquoian peoples.

J. N. B. HEWITT.

Washington, D. C., March 15.

FORTHCOMING SCIENTIFC BOOKS.[1]

THE following is a list of scientific works which will be issued by various English publishers in the course of the spring: —

Messrs. Macmillan & Co. — "Essays on some Controverted Questions," with a Prologue, by Professor Huxley; "The Beauties of Nature," by Sir John Lubbock, F.R.S., illustrated; "Island Life, or The Phenomena and Causes of Insular Faunas and Floras," including a revision and attempted solution of the problem of geological climates," by A. R. Wallace, with illustrations and maps, new and cheaper edition; "The Apodidæ," a morphological study, by Henry M. Bernard, illustrated (Nature Series); "Experimental Evolution," by Henry de Varigny; "The Diseases of Modern Life," by B. W. Richardson, F.R.S., new and cheaper edition; "The Geography of the British Colonies" — "Canada," by George M. Dawson, "Australia and New Zealand," by Alexander Sutherland (Macmillan's Geographical Series); "Scientific Papers," by Oliver Heaviside; "The Algebra of Co-Planar Vectors and Trigonometry," by R. B. Hayward, F.R.S., assistant master at Harrow; "Key and Student's Companion to Higher Arithmetic and Elementary Mensuration," by P. Goyen, inspector of schools, Dunedin, New Zealand; "Arithmetic for Schools," by Barnard Smith, late fellow and bursar of St. Peter's College, Cambridge, carefully revised in accordance with modern methods by W. H. H. Hudson, professor of mathematics, King's College, London; "Blowpipe Analysis," by J. Landauer, authorized English edition by J. Taylor and W. E. Kay of the Owens College, Manchester, new edition, thoroughly revised with the assistance of Professor Landauer; "Nature's Story Books," I., "Sunshine," by Amy Johnson, illustrated.

The Clarendon Press. — "Mathematical Papers of the late Henry J. S. Smith, Savilian Professor of Geometry in the University of Oxford," with portrait and memoir, two volumes; "Plane Trigonometry without Imaginaries," by R. C. J. Nixon; "A Treatise on Electricity and Magnetism," by J. Clerk Maxwell, new edition; "A Manual of Crystallography," by M. H. N. Story-Maskelyne; "Elementary Mechanics," by A. L. Selby; "Weismann's Lectures on Heredity," Vol. II., edited by E. B. Poulton, F.R.S; "Epidemic Influenza," by F. A. Dixey.

The Cambridge University Press. — "A Treatise on the Mathematical Theory of Electricity," by A. E. H. Love, fellow of St. John's College, Cambridge, two volumes, Vol. I. in the press; "The Origin of Metallic Currency and Weight Standards," by W. Ridgeway, professor of Greek, Queen's College, Cork, and late fellow of Gonville and Caius College; "Solutions of the Examples in 'A Treatise on Elementary Dynamics,'" by S. L. Loney, formerly fellow of Sidney Sussex College, Cambridge.

Messrs. Longmans & Co. — "Darwin and after Darwin: an Exposition of the Darwinian Theory, and a Discussion of Post-Darwinian Questions," by George John Romanes, F.R.S., two volumes.

Messrs. A. & C. Black. — "Life in Motion, or Muscle and Nerve," a series of lectures delivered at the Royal Institution, Christmas, 1891, by John Gray McKendrick, F.R.S., illustrated.

Messrs. J. & A. Churchill. — "A Treatise on Hygiene," edited by Thomas Stephenson and Shirley F. Murphy, in two volumes, with numerous illustrations, Vol. I. nearly ready; "Chemical Technology, or Chemistry in its Applications to Arts and Manufactures," edited by Charles E. Groves, F.R.S., and William Thorp (with which is incorporated "Richardson and Watts's Chemical Technology"), Vol. II. "Lighting: Fats and Oils, Candles, Stearine, Gas, Electric Lighting;" "Materia Medica, Pharmacy,

[1] From Nature.

Pharmacology, and Therapeutics," by W. Hale White; "The Student's Guide to Diseases of the Nervous System," by J. A. Ormerod, with 66 illustrations; "A Dictionary of Psychological Medicine, giving the Definition, Etymology, and Synonyms of the Terms used in Medical Psychology, with the Symptoms, Pathology, and Treatment of the Recognized Forms of Mental Disorder, together with the Law of Lunacy in Great Britain and Ireland," in two volumes, edited by D. Hack Tuke.

Messrs. Whittaker & Co.—New volumes of the Specialists' Series—"Lightning Conductors and Guards," by Oliver J. Lodge, F.R.S., with numerous illustrations; "The Dynamo," by C. C. Hawkins and F. Wallis, with numerous original diagrams; "A Guide to Electric Lighting," by S R. Bottone, for householders and amateurs, with 77 illustrations. Whittaker's Manual Instruction Series—"Manual Instruction: Woodwork," by S. Barter, Organizer and Instructor for the London School Board, and to the Joint Committee on Manual Training of the School Board for London, the City and Guilds of London Institute, and the Worshipful Company of Drapers, with over 800 illustrations; "Leather Work, Stamped, Moulded, and Cut, Cuir Bouillé, Sewn, &c.," by Charles G. Leland, author of "Wood Carving," with numerous illustrations. Whittaker's Library of Popular Science—"Mineralogy," by Dr. F. Hatch, with numerous illustrations; "Chemistry," by T. Bolas with many illustrations.

Messrs. Sampson Low & Co.—"Answers to the Questions on Elementary Chemistry, Theoretical and Practical (Ordinary Course), set at the Examinations of the Science and Art Department, South Kensington, 1887 to 1891," by John Mills, two vols., fully illustrated; "Chemistry for Students, consisting of a Series of Lessons based on the Syllabus of the Science and Art Department, and specially designed to facilitate the experimental teaching of Elementary Chemistry in Schools and Evening Classes," by John Mills, numerous illustrations; "Decorative Electricity," by Mrs. J. E. H. Gordon, with a chapter on Fire Risks by J. E. H. Gordon, and numerous illustrations by Herbert Fell, engraved on wood by J. D. Cooper; "Examination of Soils," by W. T. Brannt.

Messrs. George Philip & Son.—"Makers of Modern Thought; or, Five Hundred Years' Struggle (A. D. 1200 to A D. 1699) between Science, Ignorance, and Superstition," by David Nasmith, in two volumes; "Christopher Columbus," by Clements R. Markham, Vol. VII. of "The World's Great Explorers and Explorations"; "The Development of Africa," by Arthur Silva White, new and cheap edition, revised to date, with fourteen colored maps; "Philips' General Atlas," entirely new and revised edition, with several additional maps; "Philips' Systematic Atlas," for higher schools and general use, a series of physical and political maps of all the countries of the world, with diagrams and illustrations of astronomy and physical geography, specially drawn by E. G. Ravenstein; "Philips' Atlas of Astronomy," a series of seventy-two plates, with notes and index by Sir Robert Stawell Ball, F.R.S., Royal Astronomer of Ireland; "Tourists' Handy Volume Atlas of Europe," a series of colored maps, with notes, plans of cities, and complete consulting index, by J. G. Bartholomew.

Messrs. Swan Sonnenschein & Co.—"Animal Coloration," by Frank Beddard, Prosector to the Zoological Society, with four colored plates by P. J. Smit, and numerous wood-cuts; "Text-book of Embryology: Man and Mammals," by Dr. Oscar Hertwig, of the University of Berlin, translated and edited from the third German edition by Dr. E. L. Mark, Professor of Anatomy in Harvard University, fully illustrated; "Text-book of Embryology: Invertebrates," by Drs. Korschelt and Heider, of the University of Berlin, translated and edited by Dr. E. L. Mark, Professor of Anatomy in Harvard University, and Dr. W. M. Woodworth, Assistant Professor in Harvard University, fully illustrated; "Text-book of Geology," adapted from the work of Dr. Kayser, Professor in the University of Marburg, by Philip Lake, of St. John's College, Cambridge, fully illustrated; "The Geographical Distribution of Disease in England and Wales," by Alfred Haviland, with several colored maps; "A Treatise on Public Hygiene and its Applications in different European Countries," by Dr. Albert Palmerg, translated, and the English portion edited and revised, by Arthur Newsholme, fully illustrated; "The Photographer's Pocket-book," by Dr. E. Vogel. "Introductory Science Text-Books," additions—introductions to the study of "Zoology," by B. Lindsay, illustrated; "The Amphioxus," by Dr. B. Hatschek, of the University of Vienna, and James Tuckey, of the University of Durham, illustrated; "Geology," by Edward B. Aveling, Fellow of University College, London, illustrated; "Physiological Psychology," by Dr. Th. Ziehen, of the University of Jena, adapted by Dr. Otto Beyer, with twenty-two figures.

Messrs. Crosby Lockwood & Son.—"A Hand-book of Brewing, a Practical Treatise for the use of Brewers and their Pupils," by Herbert Edwards Wright; "A Treatise on Earthy and other Minerals and Mining," by the late D. C. Davies, third edition, revised and very considerably extended by his son, E. H. Davies; "Fuels: Solid, Liquid, and Gaseous, their Analysis and Valuation," for the use of chemists and engineers, by H. J. Phillips, second edition, revised and much enlarged.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

The Bacillus of Influenza.

IN consequence of the inaccuracy of two articles which have recently appeared in *Science* on the subject of the bacillus of influenza, the undersigned considers it necessary to give the following detailed abstract of the preliminary publications which have appeared this year in the *Deutsche Medicinische Wochenschrift* regarding the isolation and cultivation of this organism, and its relation to the disease.

The bacillus of influenza was no doubt observed by Babes in 1890, but he describes a variety of other organisms as occurring in influenza, and his communications[1] [2] show no more evidence than those of other authors of his having proved this or any other organism, to be peculiar to the disease. To the simultaneously published observations of Pfeiffer,[3] Kitasato,[4] and Canon,[5] we must look for definite information on this subject, and to them most certainly is due the credit of discovery.

Where the bacillus of influenza is found. The bacilli are found in large numbers in the sputa and bronchial secretion of those who are suffering from influenza, and also to a greater or less extent in the blood. The bacilli in the sputa have been obtained in pure culture after a new method by Kitasato, and, according to Pfeiffer, their number in sputa bears a direct relation to the progress of the disease, the bacilli disappearing together with the purulent bronchial secretion. Pfeiffer suggests, in view of this fact, that the sputa be regarded as infectious material. This author examined the purulent bronchial secretion of thirty-one cases of influenza, and in all found the bacillus, which will presently be described. In uncomplicated cases of influenza pure cultures of the organism were obtained. He reports six autopsies, in two of which he obtained pure cultures. The bacilli occur in enormous numbers and frequently are observed in the pus cells. The examination of the lungs showed that the bacilli penetrate from the bronchi into the peri-bronchial tissue and may even attain the pleural surface, where, in two of the autopsies the bacilli were obtained in pure cultures from the exsudate on the surface of the pleura. In almost every one of twenty cases examined by Canon the characteristic bacilli were observed to be present in the blood (see further under staining). He usually found four to twenty isolated bacilli in each cover-glass preparation. In six cases where

[1] Babes, V., Vorläufige Mittheilungen ueber einige bei Influenza gefundene Bakterien (Feb. 17–May 3). Centralbl f. Bakteriol., 1890, vol. vii., pp. 233–241, 460–464, 496–502, 533–538, 561–568, 598–606 (with six photographs).

[2] Babes, V., Ueber die bei Influenza gefundene feinen Bakterien (Feb. 11). Deutsche Med. Wochenschr., 1892, No. 6, pp. 113–115.

[3] Pfeiffer, R., Vorläufige Mittheilungen ueber die Erreger der Influenza (Jan. 14). Deutsche Med. Wochenschr., 1892, No. 2, p. 28.

[4] Kitasato, S., Ueber den Influenzabacillus und sein Culturverfahren (Jan. 14). Deutsche Med. Wochenschr., 1892, No. 2, p. 28 (reported to the Society of Charité Physicians, Jan. 7).

[5] Canon, P., Ueber einen Mikroorganismus im Blute von Influenzakranken (Jan. 14). Deutsche Med. Wochenschr, 1892, No. 2, pp. 28–29.

the temperature of the patient had fallen, he found the bacilli in groups of five to fifty. In three of these six cases the temperature of the patient did not rise again after it had fallen, and the bacilli found at the time of the fall of temperature, or shortly after, disappeared after three to six days. The bacilli have not been observed in other conditions, as shown by many control observations made of the sputa in cases of bronchial catarrh, pneumonia, tuberculosis, etc., and they have never been demonstrated in the blood under other circumstances.

Diagnosis of Influenza by the microscopical examination of the blood in obscure cases. Canon[1] has been able to diagnose obscure cases of influenza, especially where no cough or expectoration existed, by means of the microscopical examination of stained blood preparations. The reliability of the microscopical examination was demonstrated in six cases by culture control experiments — the bacilli in the cover-glass preparations being but few and isolated.

Morphology. The bacilli are very minute non-motile rods, one-half as broad as they are long (of the same width as B. muriseptious, about 0.2 μ) and occur in chains of three to four individuals.

Staining. The bacilli are stained by means of dilute Ziehl solution (carbolic acid, five per cent solution in distilled water, 100 cubic centimetres; alcohol, 10 cubic centimetres; fuchsin, 1 gram) or heated Löffler's methylene-blue, and, in consequence of the fact that the ends of the bacilli take up the stain more intensely than the rest of the organism (polar staining), they present the appearance, unless deeply stained (Canon), of diplococci when single, or of streptococci when several bacilli are united to form a chain. The bacilli do not stain well with basic anilins and the Gram method (Pfeiffer). They may be demonstrated in the blood of influenza cases as follows: A drop of blood flowing from the pricked finger tip, is brought in contact with a cover-glass and spread by means of a second cover-glass which is placed over the first. The cover-slips are then drawn apart, and we have two films of blood covering the surface of each, which we proceed to dry at room temperature. Place the cover-glass thus prepared five minutes in absolute alcohol, and from this into Czenzynke's solution (concentr. methylene-blue solution, 40 grams; one-half per cent eosin solution, in 70 per cent alcohol, 20 grams; aq. dest., 40 grams) for three to six hours at 37° C. On removal from the stain, wash with water, dry, and mount in balsam. This stain shows the red blood corpuscles red, the leucocytes and bacilli blue (Canon).

Cultivation of the bacillus of influenza. The bacillus requires 28° to 37° C. for its development. On 1.5 per cent sugar-agar Pfeiffer could not succeed in causing more than a second generation to grow, though minute characteristic colonies at first developed. On glycerine-agar Kitasato has succeeded in maintaining cultures alive up to the tenth generation. The colonies formed by the growth of the influenza bacillus on agar slant-cultures appear like minute watery drops, which are so small that they are easily overlooked. In a second culture, inoculated from the first, the tendency for the colonies to remain separate and distinct is more evident, this growth being regarded as perfectly characteristic. The colonies are observable by means of a hand-lens when 24 hours old.

In bouillon the growth at the end of 24 hours is poor, appearing first in the form of small particles suspended in the perfectly clear fluid. These small bacterial masses gravitate, forming a flocculent deposit and leaving the supernatant fluid clear. This mode of growth, as we know, shows them to be non-motile organisms.

Canon, in his first communication, stated that he had been unable to obtain a growth of the bacilli derived from the blood, either in bouillon, plain agar, sugar or glycerin agar. In his second publication[2] he describes a successful method he has employed for the isolation of the organisms. On account of the diminutive size of the colonies formed by the growth of the bacillus, their comparatively small number in the blood, and the fact that the blood in coagulating prevents a proper isolation of the colonies, Canon proceeded as follows: The use of Esmarch roll cultures was abandoned in favor of cultures on Petri dishes. Into the latter, not only was it possible to introduce a larger amount of blood and thus increase the number of colonies obtained, but also such cultures offered the advantage of being readily examined for the minute colonies of the bacillus by means of the microscope. The blood of influenza patients was obtained in the usual way from the finger-tip, which had been sterilized with sublimate and dried with alcohol and ether, and pricked with a needle or pen-point previously sterilized in the flame. An assistant watches that the blood as it wells forth does not coagulate, but that the drops are spherical in form. Eight to ten drops are smeared over the surface of the dish, and the latter placed at 37° C. The colonies are best seen along the margins of the smeared blood ("Impfstrich"), or in places where relatively little blood has been smeared.

Pathogenic qualities. Monkeys and rabbits are susceptible when inoculated with this organism. Guinea-pigs, rats, pigeons (Pfeiffer), and mice (Pfeiffer, Canon) are refractory.

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[1] Canon, P., Ueber Züchtung des Influenzabacillus aus dem Blute Influenzakranken (Jan. 21). Deutsche Med. Wochenschr., 1892, No. 3, p. 48.

[2] Canon, P., Ueber Züchtung des Influenzabacillus aus dem Blute Influenzakranken (Jan. 14). Deutsche Med. Wochenschr., 1892, No. 3, p. 48.

The Question of the Celts.

IT would interest me very much, and I believe it would many readers, if Dr. P. Max Foshay will adduce any positive evidence, linguistic, craniological, or artistic, to show, 1, That we have any means of deciding about the language of the Ligurians; 2, That the descendance of the Auvergnats from the Ligurians can be traced; or, 3, That the Euskarian dialects are related to the Ural-Altaic group. According to Dr. Heinrich Winkler, probably the highest living authority on the Ural-Altaic languages, the Euskarian or Basque language has absolutely no relation to any member of the group.

D. G. BRINTON, M.D.
Philadelphia, March 29.

AMONG THE PUBLISHERS.

IN the next number of *The Illustrated American*, No. 111, dated Saturday, April 2, will be commenced a series of illustrated articles by Professor Warren K. Moorehead, on the ancient and extinct race of people known as the Cliff Dwellers, formerly inhabiting that part of the country of the upper Colorado, the San Juan, and its tributaries. This scientific expedition has been sent out under the auspices of *The Illustrated American*. The progress and result of this expedition will be published from time to time in the columns of that excellent weekly.

— F. A. Davis, Philadelphia, has recently issued a book, by Hartvig Nissen, entitled "A B C of the Swedish System of Educational Gymnastics." Mr. Nissen is instructor of physical training in the public schools of Boston, and has been connected in a similar capacity with many of the leading educational institutions of this country and Europe. Since the Swedish system of educational gymnastics has been introduced into the public schools of Boston, it has become a necessity to have a practical hand-book, both for the teachers and the many homes where gymnastics are practised. It is with the purpose of giving plain answers to the most frequent questions that this book has been written.

— With the April number the *Review of Reviews* enters upon its second year. It has had an exceptional, if not an altogether unique, history. One year ago it was known only to a few discriminating readers, and its subscription list and news-stand sales required only a few thousand copies. Its edition the present month is 70,000 copies, and it is eagerly read in every State and Territory in the Union and in every part of Canada. No extraordinary efforts have been made to push the magazine. There has been very little canvassing done for it; no chromos have been given to its subscribers; no special inducements, such as an encyclopædia or a parlor organ thrown in as a gratuity or offered at half-price, have been offered by the publishers. The magazine

has grown to an enormous circulation and to commanding influence simply upon its merits. Its readers have liked it and therefore recommended it to their friends. It owes not a little to the newspapers of the country, which have appreciated the journalistic enterprise and vigor and the enormous amount of hard, honest labor put into every number, and which have most heartily recommended it to their readers. While working in the closest co-operation with the English *Review of Reviews*, edited by Mr. W. T. Stead in London, the American *Review* is a distinct magazine, wholly and entirely edited, printed, and published in New York, and in the fullest sense of the word as much an American periodical as Mr. Stead's London edition is an English periodical. The general aims and purposes, plans and methods, of the two magazines are identical, and each has the fullest access in advance to all the materials and illustrations prepared for the other. The American *Review*, being somewhat larger and higher priced, is more profusely illustrated. It has twenty or thirty more pages each month than the London edition. Its bound volumes, covering the past year, are a history of current action and thought, and a portrait gallery containing the faces of seven or eight hundred people of contemporary note, representing all parts of the world.

CALENDAR OF SOCIETIES.

Philosophical Society, Washington.

Mar. 26.—S. P. Langley, A Biographical Notice of General Meigs; Lester F. Ward, The new Psychology and what it Promises; T. Russell, River Stage Predictions.

Publications received at Editor's Office.

ADAMS, OSCAR FAY. The Presumption of Sex and other Papers. Boston, Lee & Shepard. 16°. 149 p. $1.

BERNHARDT, WILHELM. Anderson's Bilderbuch ohne Bilder, with notes and vocabulary. Boston, D. C. Heath & Co. 16°. paper, 127 p. 35 cts.

BOTTONE, S. R. A Guide to Electric Lighting. New York, Macmillan & Co. 16°. 189 p. 75 cts.

BUTLER, N. M. The Place of Comenius in the History of Education. Syracuse, C. W. Bardeen. 16°. paper, 20 p.

CHENEY, SIMEON PEASE. Wood Notes Wild: Notations of Bird Music. Edited by J. W. Cheney. Boston, Lee & Shepard. 12°. 276 p. $2.

EVERETT, C. C. AND OTHERS. The New World: a Quarterly Review of Religion, Ethics and Theology. Boston, Houghton, Mifflin & Co. Vol. I. No. 1. 8°. 200 p. 75 cts. $3 a year.

STORER, F. H. Agriculture in some of its relations with Chemistry. 4th ed. New York, Charles Scribner's Sons. 2 vols. 8°. pp. 561, 596.

STRE, DAVID. On the Modifications of Organisms. Melbourne, George Robertson & Co. 12°. 172 p

QUERY.

Can any reader of *Science* cite a case of lightning stroke in which the dissipation of a small conductor (one-sixteenth of an inch in diameter, say,) has failed to protect between two horizontal planes passing through its upper and lower ends respectively? Plenty of cases have been found which show that when the conductor is dissipated the building is not injured to the extent explained (for many of these see volumes of Philosophical Transactions at the time when lightning was attracting the attention of the Royal Society), but not an exception is yet known, although this query has been published far and wide among electricians.

First inserted June 19. No response to date.

N. D. C. HODGES,

874 BROADWAY, NEW YORK.

SCIENCE

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

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SCIENCE

NEW YORK, APRIL 15, 1892.

A NEW PATENT OFFICE.

In our issues of Jan. 29 and April 1, attention was called to the needs of the Patent Office and the great injustice which was persistently maintained against inventors, the public, the nation as a whole, and the official staff of the Patent Office by the criminal over-crowding of that office consequent upon the insufficient space assigned it in its own building, by the shameful absence of provision for ventilation, and, not least, by the introduction of the offices of the Interior Department into a building erected with the money of inventors taxed heavily for the privilege of giving a wealth and a prosperity to their country, far beyond anything seen elsewhere in the world.

We now observe that the daily papers report that on the 7th instant Senator Falkner introduced a bill, not to give the Patent Office the control of its own building and to appropriate the $4,000,000 or so much as may be needed of it to the extension and improvement of that building, *but* to erect a new building. The cost is not to exceed $3,500,000, and $500,000 is appropriated to begin the work. In other words, this proposition—it may never be more—is to give to the Interior Department a building erected at a cost of $3,000,000 by the inventors of the country, mostly poor men struggling against every misfortune, and *then* to take an additional $3,500,000, also contributed by these needy inventors for the privilege of making their country and its already wealthy men still wealthier, and appropriating *that* to the construction of *another* building for the Patent Office. In other words still, it is proposed to take of the $7,000,000 which we have, in the course of the century, forcibly wrenched from the almost empty purses of our thousands of talented but needy inventors as a tax upon them for enriching their country, one-half the whole for the construction of a building that it is a disgrace to the nation not to have given them long ago, and to give the other half to a Department which has absolutely no claim upon it, which has been an incubus upon the work of the Patent Office for years, and which is to-day through the exercise of technical legal power and in defiance of justice and public policy, a "squatter" on the territory of the Patent Office and a nuisance there. It seems remarkable that this should be possible, in the face of justice and in spite of the united power of all the inventors in the land, of all their representatives, and of all the members of the legal profession who are daily earning their fees by doing the business of these wronged inventors. The whole matter is a standing disgrace to the country and our representatives in Congress, and a crying injustice to the men who have built up the whole modern system of production of the United States.

The *Scientific American*, referring to proposed legislation by which it is provided that foreign inventors shall be taxed the same amount in this country as in their own for such protection, says:—

"The theory upon which we grant patents and the object of our patent laws is the promotion of useful arts and industries, not the taxation of inventors. The aim of our patent laws is to encourage the study and development of new inventions, whereby multiplied and diversified forms of novel industries are made accessible to the people; for by industries they thrive. The American law as it stands invites inventors throughout the world to bring hither their new inventions and set up their new industries. In reward for so doing it grants them a patent for seventeen years, after which the invention becomes free to the public. The larger the number of patents granted, the greater will be the number of new industries established, and our measure of prosperity will be correspondingly increased. As a people we have everything to gain and nothing to lose by encouraging inventors, no matter where they live or where they were born."

It is in this, as we consider it, correct theory of the patent system that all our legislative action and every policy relative to patents should be determined. Make the patent-fees as small as is practicable; stimulate inventors to bring out their inventions; insure the most complete and perfect protection; and give the inventor at least the full worth of his money. It is scandalous and disgraceful to tax a poor man for the privilege of promoting the best interests of his country. Not one inventor in thousands acquires a competence; but the inventions of these very men make the nation and its capitalists rich. If the whole $7,000,000 contributed by them to the Patent Office treasury is needed to insure this they should have it—and ten times more if good use can be made of it.

OBSERVATIONS ON THE GROWTH AND CHEMICAL COMPOSITION OF THE MAIZE (CORN) PLANT.

June 12, 1891, seventy-five hills were selected in a field of Leaming corn planted May 15. Each hill contained three corn plants, and they were as nearly uniform in appearance as could be found in the field. The seventy-five hills were divided into fifteen lots, each lot containing five hills. Beginning June 12, and every week thereafter during the season, the plants in four hills of corn in one plat were cut close to the ground. The plants from one of these hills were dried and preserved. A chemical analysis was made of the plants from each of the remaining three hills, so that during the growing season these analyses were made of triplicate samples taken each week. The fifth hill of corn in each lot was left to grow, and was measured each week during the season. Each corn plant in the seventy-five hills was measured every week until it was cut. These measurements included the height to the tip of the upstretched longest leaf and also to the tip of the tassel when it was present, making a total of 3,159 measurements.

The soil in which the corn was grown was very uniform prairie land, located in central Illinois. The season was below the average for corn-growing because of the drouth.

Like almost everything else that grows, the plants did not all make the same amount of growth in height each week. There was quite a variation in the growth of the different

stalks, the maximum height being reached about Aug. 1; but, as will be seen further on, the plants had acquired at that time less than one-half of their total dry matter.

A condensed summary of some of the observations made is given in the following table: —

During the week ending Aug. 14 the record shows that for this season an unusually large quantity of rain had fallen, and the plants which were analyzed that week showed a smaller quantity of dry matter than those of the week before.

Week Ending.	Number of Plants Measured.	Height of Plants (inches).		Field-Notes.	Dry Matter per Plant (grams).	Rain-fall (inches).	Average Daily Temperature, Fahr.			Percentage Composition of Dry Matter.				
		Extremes	Average.				Mean.	Maximum.	Minimum.	Ash.	Protein.	Crude Fibre.	Nitrogen Free Extract.	Ether Extract.
June 12	2 5	11-26	16			.48	66	76	55					
19	225	23-43	31		4.5	.30	75	90	62	11.2	27.5	23.3	35.7	2 2
26	213	32-64	47		19.9	1.20	75	86	60	11.8	24.1	25.4	36.7	1.9
July 3	201	50-84	65		30.4	.03	72	85	58	11.5	19.1	18.1	39.4	1.9
10	189	57-91	73		50.0	.07	68	81	51	10.5	19.1	29.2	39.5	1.6
17	177	59-102	84		114.2	.47	72	86	57	8.9	15.7	30 6	42.8	1.8
24	165	64-111	96	Full tassel.	161.5	.20	73	86	60	7.9	12.1	29.1	49.2	1.6
31	153	81-115	98	Silks alone.	161.2	.67	68	80	54	7.1	11.3	28.1	51.0	2.4
Aug. 7	141	82-116	98	Pollen shed. Silks dead.	215.1	.01	71	87	55	6.0	10.8	26.7	54.6	1.8
14	129	82-118	98		200.0	1.35	74	94	62	6.8	10.8	29.5	51.2	1.5
21	117	82-118	97	Roasting ear stage.	256.0	1.28	75	86	67	6.2	10.3	27 5	53.9	2.0
28	105	82-115	97	Corn denting.	294.9	.13	62	74	50	5.7	9.3	24.7	57.5	2.6
Sept. 4	93	81-114	97	Husks turning brown.	349.5	.34	63	77	49	5.1	8.5	21.7	61.7	2.9
11	81	81-114	96	Husks dry.	319.7	0	62	76	46	5.0	8.9	20.4	62.8	3.0
18	69	81-113	93	50% leaves dead.	290.0	.0	73	90	57	5.2	9.7	19 7	62 5	2.8

The figures giving the grams of dry matter per plant and the composition of the dry matter represent an average per plant of the nine analyzed each week, or three hills of corn, each containing three plants. No attempt was made to separate the different parts for analysis, such as the ear, stalk, and leaves, but that part above ground was taken as one plant.

The rainfall during the season was considerably below the average, and is here given in inches: —

Average.	June.	July.	August.	September.
For ten years.	5.04	2.75	3.45	3.27
For 1891.	2.08	1.41	2.86	0.41

The record shows that the average maximum height per plant was attained during the week ending July 31; but it contained at that time only 46 per cent of the maximum quantity of dry matter.

The growth in dry matter continued till Sept. 4, and the decrease after that date probably was due to breaking off and blowing away of dry or dead portions of the leaves.

Assuming the total height per plant to be 100 inches and that it was 19 inches high June 12, or 19 per cent of its total height, also that the maximum growth in weight was 350 grams of dry matter, the percentage of the total height and weight attained each week is as follows: —

	June 12	19	26	July 3	10	17	24	31	Aug. 7	14	21	28	Sept. 4	
Height.	19	13	17	19	9	10	11	2 = 100 total.						
Weight of Dry Matter.		1.3	4 6	3 2	5 8	18.5	12	0	15.6	0	11.9	11.3	15.8	= 100 total

The omission of two weeks in the record where no increase in dry matter was found is caused by the fact that we cannot have the plant and analyze it too.

The analyses of the dry matter show that 100 pounds of the corn plant has quite a different composition at the various stages of its growth. The percents of ash, or mineral matter, and also of protein are highest when the plant is young, and these decrease with age; while the nitrogen-free extract, or carbo-hydrates, increases in percentage as the plant matures.

Assuming that there are 10,000 corn plants per acre, which number it has been found is a fair estimate of the thickness of planting in Illinois, these analyses show that an acre of corn grown to maturity contains 7,716 pounds of dry matter, and this dry matter is composed of 394 pounds of ash, or mineral matter, 656 pounds of protein, and 6,666 pounds of carbo-hydrates.

E. H. FARRINGTON.
Chemist, Agricultural Experiment Station,
Champaign, Ill.

THE TOMB OF KING AMENHOTEP.

THE tomb of King Amenhotep IV. has at last been brought to light in the nekropolis of Tel-el-Amarna in middle Egypt.

Since the close of the year 1890 the direction of explorations in Egypt has been occupied in clearing the two most important groups of graves in the neighborhood of this site, which belonged to the eighteenth dynasty, and many tombs have already emerged from the heaps of *debris* under which

they lay concealed, and their entrance had been protected with iron doors.

One of these, No. 25 on the plan, has at last been identified as the long looked-for hypogeum of the king. The main entrance-passage, cut into the mountain to a depth of fifty metres, opens into a chamber supported by four pillars. To the right of this passage, another corridor, forty-five metres long, branches out, opening into an unfinished chamber thought to be that of the queen. Somewhat further, on the same side, are three chambers, two of which are decorated with paintings; and among these occurs the name of the young princess Aten-Macht, the second daughter of Amenhotep IV. The decorations on the walls of the king's chamber represent him surrounded by his family, in adoration before the sun. The condition of the tomb when found showed it to have been disturbed in ancient times, a fact for which the circumstances of this reign furnish abundant explanation.

Until 1887 all that was known of Amenhotep IV. was that he peacefully succeeded his great father, Amenhotep III., whose queen was a foreigner; but that having selected for his only god the life and light-giving sun-disk "Aten," and having attempted to establish his worship to the exclusion of that of other gods, and particularly of that of Amon, he antagonized the arrogant priesthood, whose growing power was already then a force that the Pharaohs must count with. In consequence of this, he found it expedient to leave Thebes and to remove his court and the seat of government to middle Egypt, where, at some seventy-five kilometres south of Minieh, he founded the new city, "Khu-n-aten," i.e., Splendor of the Disk, the site of which is now known as Tel-el-Amarna.

Consistent in his unconpromising hatred of Amon and his priests, he changed his own name in which that of the now discarded god of his fathers entered as an element, and was henceforth called "Khu-n-aten."

He seems to have been a devoted husband and father, and the worship he introduced — and which, after all, was but a return to ancient sun-worship, and therefore more of a reform than an innovation — seems to have been a lofty one, if one may judge from the aspirations kindled by it in the souls of its worshippers, as expressed in the beautiful hymns that have come down to us.

Khu-n-aten left only daughters. At his death his sons-in-law, who succeeded him, had not the strength to continue the struggle; they gradually abandoned his faith to return to the old popular worship, and the eighteenth dynasty closed with a period of disturbance, indicated by the shortness of the reigns.

Was Khu-n-ated only a religious reformer, a mere fanatical monotheist, who, as has so often been stated, was urged by a devout foreign mother to break with the traditions of his father's race, and whose blind intolerance tried to enforce his own views upon his people? or was he a shrewd, far-sighted prince, who, perceiving the danger to the royal power lurking behind the increasing pretentions of the Theban priesthood, sought to put a check upon their encroachments and to insure the independence of the crown by removing the court and by surrounding himself with foreigners, thus defying this formidable caste?

The latter view receives support from the fact that it is against Amon alone that the king's animosity was practically directed, and that, whilst the worship of the disk was the official religion of the capital, the names of the other divinities of Egypt remained undisturbed upon the monuments of his reign, and Amon's name alone was everywhere erased.

In 1887 the discovery of the archives of Khu-n-aten, consisting of some three hundred cuneiform tablets, containing important correspondence between Egypt and its Asiatic allies and tributaries, as well as official reports from royal lieutenants in foreign lands, threw a most unexpected light upon the condition of the ancient civilized world in the fifteenth century B.C. Among the many interesting glimpses thus obtained is a mention of Canaan in pre-Exodus times, found in a letter from the tributary king of Jerusalem, which reveals the existence of that city at that remote period.

The fact that the correspondence between Asia and Egypt was conducted in the Neo-Babylonian characters was alone sufficiently extraordinary to draw the attention of the learned world to Tel-el-Amarna and to the remarkable figure of the man who, in his day, filled not only that spot, but no doubt the whole civilized world, with his strong personality. There are many peculiarities connected with the monuments of his reign and with the art they betray that have never yet been quite satisfactorily explained; and despite all that has been written, and the ingenious theories that have been advanced on the subject, there still remains enough that is hypothetical to make any monumental discovery connected with this period of the greatest interest to scholars.

S. Y. STEVENSON.

A SIMPLE APPARATUS FOR THE PRODUCTION OF LISSAJOU'S CURVES.

THE requisites are a piece of thin glass tube or rod, a gas flame, and a slight knowledge of elementary glass working. The apparatus consists of a short piece of rod or tube which serves as a base or handle, to which is fused a glass thread ten or fifteen centimetres long and from one-half to one millimetre thick, carrying at its extremity a second and much thinner thread of about the same length, whose free end is fused into a small clear bead. Both threads are in the same line with the handle, and the whole forms a compound rod.

In constructing this rod, two glass threads of the kind already indicated are selected rather longer than required. They are fused together, and the connection straightened by a gentle pull while still soft. The double rod is then held near its centre, and the finer thread shortened until in vibration it appears, by persistance of the visual impression, as a sheet or cone. The thicker thread is next adjusted in the same way until the vibration of this double rod, when held by its thicker end, is sufficiently rapid. This thicker end is now attached to a larger piece of glass (the handle), and a very small bead formed at the other end. The exact position and weight of the bead required to form any given set of curves must be found by trial.

Now, holding the bead in a strong light, stand nearly facing the light, but so as to see the bead with a dark background, and tap the handle lightly with the finger-tips. If the adjustment is perfect, the bead will appear transformed into a shining curve, oscillating or rolling and twisting upon itself with inimitable grace like a living thing, and dying away with the decreasing amplitude of the vibrations.

These curves are represented approximately by the equations: —

$$x = a \cos m\theta$$
$$y = b \sin (n\theta + \alpha),$$

where a and b are the amplitudes, α is the phase-difference, and the ratio $m : n$ is a function of the time. When the

ratio $m : n$ can be expressed by small integers the curve is completely shown by this apparatus. When this ratio cannot be expressed by small, but can by moderate, whole numbers, the curve cannot well be seen, but may be readily photographed. The most beautiful effects are seen when the ratio $m : n$ has almost some such values as 1:1, 1:2, 2:3, or 3:1. The values of a, b, and α vary with every tap of the finger, and thus a single apparatus will show a great variety of curves of one class.

I have not tried projecting these curves with a lantern, but I see no difficulty in the way of such a proceeding.

Clark University. T. PROCTOR HALL.

VALUABLE EXPERIMENTS IN VEIN-FORMATION.

IN No. 3, Vol. XII., of the *School of Mines Quarterly* there appeared a short paper "On the Genesis of Ore-Deposits," by W. H. von Streeruwitz, the chief of the Western Division of the State Geological Survey of Texas.

In these days of hasty conclusions and the overcrowding of scientific literature with opinions and half-developed theories, it is refreshing to run across an occasional example of undue modesty in presenting the results of elaborate experimentation. My excuse for thus tardily calling attention to a marked case of this character, entirely without the knowledge of the author, is the conviction that the gentleman himself will not lay claim to full credit for the work which he has planned and executed in a thoroughly scientific manner. Especially does this action seem fitting as preliminary to an extension of the same investigations by the present writer in the metallurgic laboratory of the Arizona School of Mines. In fact, it is only just to confess that the inspiration of these last experiments, for which preparations are now being made, came originally and wholly from the most interesting results of Professor von Streeruwitz's patient and intelligent observations in his laboratory at Houston, Texas.

In the paper quoted Professor von Streeruwitz does not make very clear how much of the value of his well-fortified conclusions rests upon the skill with which he has himself conceived and executed a most convincing series of experiments. But those who have seen some of the tubes with miniature veins of gold, silver, copper, lead, etc., and others with beautifully formed agates, need only the concise reasoning of the article referred to, in order to understand the originality, perseverance, and devotion to truth with which the investigation has been carried out through several years of diligent experimentation.

In the language of our author, the experiments would, so far, appear to establish the following points, viz.: —

1. It is principally the iron which, in silico-ferruginous fissure veins, brought the other metals from greater to (by mining) accessible depths.

2. Most siliceous ore-leads, carrying also large quantities of iron and having silico-ferruginous outcrops, seem to be deposited from hot aqueous solutions of the metals and silicates.

3. Metals and metal combinations contained in the rock surrounding the fissures and crevices were probably leached out by the hot liquids contained in the fissures and precipitated on and combined with the siliceous iron growing up in the fissures.

4. The fissures could be charged with ore-veins in a comparatively short time, since, no doubt, high temperature and galvanic currents existed in the fissures at the time of formation of the ore-gangues.

5. In contact-gangues the precipitation and deposition of ores was materially facilitated by galvanic currents caused by the contact of different rocks, and it is owing to the prevalence of galvanic currents that in most cases richer deposits at the intersection of two or more leads were formed.

6. The so-called iron outblows ("gossan," "eiserner hut," "Pacos," "Colorados," etc.) are frequently not the product of igneous eruption, but a deposition product from aqueous solutions; and alterations in the rocks contiguous to such outblows are not necessarily the result of eruptive agencies, but of a leaching process.

7. The formation of banded agates does not always take place, as is generally believed, in the cavities of a rock, but can also occur free in solutions; and the thickness of the bands progresses from the centre outwards, although a reverse process by osmosis may be possible under certain conditions.

The bases for these conclusions are somewhat more explicit than might, perhaps, be inferred from a reading of Professor von Streeruwitz's paper alone, but, as he is most careful to insist, the experiments possess their greatest scientific importance in the element of suggestiveness for future inquiry. It is remarkable that so little has heretofore been done in such directions; and, like the admirable flexure tests of the United States Geological Survey in orographic work, they point out little-trodden fields in geology which offer rich rewards to capable investigators who will approach the problems in inductive experimental mood, following the guidance of results as they are gradually manifested.

No one will be better pleased than Professor Streeruwitz to know that others are earnestly engaged in this study. The incidental discoveries, whatever they may be, are liable to prove as interesting and valuable as any which may be directly sought. Indeed, it is impossible at this juncture to predict to what legitimate length the investigation may lead.

The main thing to be desired is the inauguration of a large number of experiments with as widely varied conditions as possible of material, situation, environment, and activity. While co-operation is not really essential, it can do no harm and may result most beneficially. May not some of our zealous young geologists be induced to undertake this work, which should be continued with constant observation for a term of years?

Instruction will gladly be given to any who may require it, and from those who cannot otherwise aid the cause thoughtful suggestions will be most welcome.

THEO. B. COMSTOCK.
Director School of Mines, Tucson, Arizona.

ROYAL METEOROLOGICAL SOCIETY.

AT the meeting of this society on Wednesday evening, March 16, Dr. C. Theodore Williams, the president, delivered an address on the "Value of Meteorological Instruments in the Selection of Health Resorts." He drew attention to thermometers, maximum and minimum, as the foundation-stone on which medical climatology rests, and instanced effects of extreme cold or heat on the human organism. The direct rays of the sun are of the greatest importance, and in health resorts should be utilized to the full; in fact, only climates where, during the winter months, even a delicate person can lie or sit for several hours a day basking in the sunshine are to be recommended for most complaints, and the various forms of sunshine recorders are used to aid the medical adviser in choice of such health stations.

After referring to the value of rain-gauges, hygrometers, and barometers, Dr. Williams stated that many health resorts owe their reputation almost solely to their shelter from cold winds; for

instance, the advantage in climate which Hyeres and Mentone enjoy over Marseilles is chiefly due to their being more sheltered from the mistral, or north-west wind, the scourge of the lower valley of the Rhone from Valence to Avignon. He went on to describe the climate of the Riviera, illustrating it by lantern slides from recent photographs, including views of Hyeres, Costabella, Cannes, Nice, Mentone, San Remo, etc., and he showed the three principal causes of the warm winter in this region to be: (1) the southern latitude; (2) the protection from cold winds by mountain ranges; and (3) the equalizing and warming influence of the Mediterranean Sea, which being practically tideless is always equally potent, not varying with hour and season. Dr. Williams mentioned the weak points of the south-of-France climate, with its blustering mistral, its occasional cold bise, its moist sirocco-wind; but summed up the Riviera winter climate as being, on the whole, clear, bright, and dry, with fog and mist practically unknown, with a winter temperature of 8° to 10° higher than England has, though subject to considerable nocturnal radiation, with about half the number of rainy days and four to five the number of bright ones which she can boast of, with cold winds and cold weather, without which it would lose its health-giving effect.

After the delivery of this address the meeting was adjourned in order to allow the fellows and their friends an opportunity to inspect the exhibition of instruments relating to climatology which had been arranged in the rooms of the Institution of Civil Engineers, 25 Great George Street. The Meteorological Office showed a set of instruments necessary for the equipment of a climatological station, viz., Stevenson thermometer-screen, fitted with dry-bulb, wet-bulb, maximum and minimum thermometers; and also a rain-gauge. Thermometers were also shown for ascertaining the temperatures on the ground, under the ground, and at a distance, as well as for recording temperature continuously. Various forms of sunshine recorders were exhibited, as well as a number of actinometers and solar radiation instruments for ascertaining the heating effect of the solar rays. The exhibition included a large and interesting collection of hygrometers, also several rain-gauges and other instruments. Among the curiosities is a piece of plate glass which was "starred" during a thunder-storm on Aug. 21. 1879; this was not broken, but it has a number of wavy, hair-like lines. The exhibition contains a large number beautiful photographs of clouds, lightning, and snow-scenes, as well as of the damage done by the destructive tornado at Lawrence, Mass., U.S.A.

NOTES AND NEWS.

ON April 16, at the Department of Archæology and Palæontology of the University of Pennsylvania, will take place the opening of the Loan Collection of Objects used in Worship, already referred to in these columns

— A very intense light, such as is required for photographic or occasionally for medical purposes, may, as is well known, be readily obtained by burning magnesium ribbon, which has, however, the disadvantage of being somewhat expensive. An excellent substitute, according to *Lancet*, has been found by a French chemist, M. Villon, in aluminium, which is about a third of the price of magnesium, and which may be utilized in the same manner by burning it in a spirit lamp, or, if a flame of much more intense brilliancy is required, in a coal, gas, or spirit flame supplied with a jet of oxygen. In these it burns without emitting fumes, in which respect it is superior to magnesium. The light given by aluminium has a high actinic power — nearly as high, indeed, as that of magnesium. The most convenient way of obtaining a very intense light, according to M. Villon, is to use a lamp provided with a jet of oxygen at the centre of its flame, into which powdered aluminium mixed with a quarter of its weight of lycopodium and a twentieth of its weight of nitrate of ammonium can be projected by means of a tube furnished with an air-ball. This gives an exceedingly intense light, without smoke. A mixture of aluminium powder with chlorate of potash and sugar can be ignited, giving an intense light by means of gun-cotton, but is somewhat dangerous. Probably the best plan for medical photography, or for laryngoscopic and auroscopic and other demonstrations, would be to burn a ribbon of aluminium in an ordinary spirit lamp. Of course, if oxygen and an oxy-hydrogen, or an oxy-alcoholic, lamp were at hand a much more intense light could be obtained.

— The London *Times* of March 24 printed the following communication from a correspondent: Under the direction of the Austrian Government an interesting series of deep-sea explorations has been conducted recently in the eastern parts of the Mediterranean, by a scientific party on board the "Pola." At one point, about 50 nautical miles south-west from Cape Matapan, the "Pola" found a depth of 4,400 metres (2,406 fathoms), followed within a few miles further east by a depth of 4,080 metres (2,236 fathoms), which are the greatest depths recorded in the Mediterranean. They have received from the Austrian Hydrographical Board the name of Pola Deep. The great depression of the Mediterranean must thus be shifted considerably east from its former central position on the maps. Another deep area was explored between Candia and Alexandria—the depths attaining from 3,310 metres (1810 fathoms) some twenty miles south-east of Grandes Bay, and from 2,392 metres (1,208 fathoms) to 2,120 metres (1,322 fathoms) within a short distance from Alexandria; the maximum depth sounded being 3,068 metres (1,678 fathoms) in 28° 39′ 30″ north latitude, and 33° 19′ 54″ east longitude. The highest temperature was found during the first part of the voyage, at depths of 1 to 50 metres, the highest being 60.8° Fahrenheit at 1 metre; the lowest temperature, 52¼°, was observed at the issue from the Adriatic Sea, at a depth of 760 metres. In explorations conducted some two years ago in the Central Mediterranean, it was observed that the density of the water and its saturation with salt increased with depth, and the same was noticed in the western part of this year's cruise. But in the Eastern Mediterranean the density of water varies but very little in the different strata, and it is higher on the whole than in the west. The transparency of the water is very great in the Eastern Mediterranean. Altogether the "Pola" made no fewer than 50 deep sea soundings, 27 of which touched depths of more than 1,000 metres.

— P. Blakiston, Son, & Co., Philadelphia, announce that they will soon publish "Physical Education," by Frederick Treves, F.R.C.P. The subject of physical education as a hygienic measure has recently attracted so much attention from school boards, the medical profession, and sanitarians generally, that it now ranks in importance with the various branches of study pursued in our public schools and colleges. To the average city man or woman of sedentary occupation physical exercise is of quite as much consequence as it is to school children and college students. It is, however, often taken up unwisely and to the lasting harm of those who in ignorance attempt methods that are unsuited to their physical condition. It has therefore been thought advisable to publish, from the advance sheets of "A Treatise on Hygiene," this paper by one of the best known medical writers of the day, that it might be within the reach of those who would not perhaps care to purchase the larger work in which it will be included.

— Houghton, Mifflin & Co. announce that Mrs. Olive Thorne Miller adds to her two excellent books about birds already published by this firm a third, to which she gives the title, "Little Brothers of the Air." It describes between twenty and thirty different birds, and for all lovers of birds, who are happily very numerous, this little book has special attractions. Professor Child has prepared the eighth part of his remarkable edition of "English and Scottish Popular Ballads." It was originally expected that the work would be complete with the eighth part, but Professor Child has been successful in discovering a good deal of material which he had hardly anticipated finding, so that at least one more part is necessary to complete the work. "The Satchel Guide for the Vacation Tourist in Europe" has been revised for 1892, and, as heretofore, holds the first rank among Guides for those who wish to cover only a part of Europe, and make a tour instead of a thorough continued study of many places.

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Attention is called to the "Wants" column. It is invaluable to those who use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

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THE EVOLUTION OF COMMERCE.[1]

FOR over three thousand years the great highway for commerce has been from India by the Persian Gulf and the Euphrates or by the Red Sea to the Mediterranean, and thence through the Mediterranean by Gibraltar to western and northern Europe, and, in our day, thence to America.

Along this route cities and nations have sprung up, increased in wealth and power, and passed away, giving place to other cities and nations further westward. These nations have been great carriers and distributors of minerals and goods, as well as capitalists and bankers, or carriers, bankers and manufacturers; in either case controlling the commerce of the world. This control has never for any long period been held by the same race, but has passed from one nation to another, always from the east toward the west.

The earliest highway of commerce was from India through the Persian Gulf, up the Euphrates to the Mediterranean; and carpets and precious stones were then as now carried over this route. Explorations and surveys for a railroad have been recently made along this "our future highway to India." Caravans brought spices from Arabia and rich stuffs from Babylon and Nineveh to the shore of the Red Sea. Solomon made a navy of ships and Hiram sent in the navy his "Servants, shipmen that had knowledge of the sea, and they brought gold from Ophir, great plenty of almug trees, and precious stones."

Tyre and Sidon founded colonies on the shores of the Mediterranean, enslaving the Spaniards and compelling them to work the mines of gold and silver already opened in Spain. Their ships sailed through the Mediterranean, by the Pillars of Hercules, into the Atlantic Ocean, turning northward to England for tin and copper and on into the Baltic Sea for furs and amber; turning southward along the western coast of Africa, passing certainly two thousand miles to the equator and probably rounding the Cape of Good Hope into the Indian Ocean. Products from the west were brought in ships to Tyre and Sidon and exchanged for the goods of the east, their merchants making profits on each transaction both as merchants and as carriers. Tyre and Sidon became wealthy, luxurious, and effeminate. Some of their citizens saw in Africa a richer soil and a better situation for a large city, and founded Carthage. The Carthaginians inherited the trade of Tyre and Sidon, and in addition opened highways to Egypt and into the interior of Africa, bartering their wares in Egypt for corn and grain and in Africa for ivory, gems, and slaves. They planted colonies in Africa and Sicily, and for a time were successful rivals of Greece and Rome.

The rule of the ocean transferred from Asia to Africa remained there but a short time, for the day of Europe came with the rise of Greece and Rome.

The Greeks founded colonies in Asia Minor, Sicily, and Italy. The ruins of great cities with Grecian temples and amphitheatres are found at Girgenti and Syracuse in Sicily, at Pæstum and other places in Italy. Under Pyrrhus, their armies were defeated by the Romans and their colonies captured. Deprived of these, their power rapidly declined and Greece became a Roman province.

Rome.

Rome founded few colonies, but she conquered the nations of Asia, Africa, and Europe, and brought under her sway cities, kingdoms, and empires. She boasted of five hundred cities in her Asiatic province that had been founded or enlarged and beautified by the Cæsars. One hundred and twenty vessels each year brought the goods of India from the delta of the Ganges, and large fleets from Egypt came laden with corn and grain. She imported from every country, but exported little, paying for her imports by taxes levied on her colonists.

Rome was the first power to incorporate conquered states into her dominion and extend citizenship to all the people in her empire; so that Paul could say in truth, "I am a Roman citizen and to Cæsar I appeal." So salutary and beneficial was her rule that under it these countries prospered more than under their own rulers. What Rome seized with strong hands she defended, and in return for taxation gave protection. She has no more enduring monuments than her roads, the remains of which are now found in every country of Europe. Though built as military and post-roads, they were used largely for commerce. All started from the golden mile-stone in the forum; one ran over the Brenner pass north-eastward to the Baltic Sea, another followed the north-western coast of the Mediterranean to Spain and southern France, another crossed the Alps and extended through France to the British Channel and through England to Scotland, where the Romans built a wall, ruins of which now bear witness to its strength. Another way went southward to Naples and Brindisi, and another led eastward to Macedonia and Greece. As these were the only roads in all these countries, it was truly said, "All ways lead to Rome;" and over them the messengers of Cæsar travelled more rapidly than the mail-carrier of our fathers on our mail-routes.

Venice and Genoa.

After five hundred years of empire Rome fell, and the Dark Ages followed. From A.D. 400 to A.D. 800 commerce and trade died out. The only vessels on the Mediterranean and Baltic were piratical crafts; Jerusalem and the Holy Land were captured by the Turks; the Crusades began, forerunners of a higher civilization and more extended commerce. Thousands and tens of thousands of people from all parts of Europe and all ranks of life, bearing the pilgrim's badge — the blood-red cross — journeyed toward the Holy Land, first in vast crowds led by Peter the Hermit, then in great armies led by kings and generals. For two hundred years this movement continued. Venice and Genoa furnished ships to carry the armies of France from Italy to the Holy Land. The Venetians were shrewd merchants and drove hard bargians, stipulating for cessions of land at the best commercial points and adequate compensation for their services. After the failure of each Crusade they brought back remnants of the troops and pilgrims, and with them the products of Asia Minor, and books and art treasures from Greece. These were distributed all over Italy, and led to the renaissance of the thirteenth and fourteenth centuries.

The trade with the East brought power and wealth to Venice

[1] Annual address by the president, Hon. Gardiner G. Hubbard. Presented to the National Geographic Society Jan. 15, 1892. Nat. Geog. Mag., Vol. IV., 1892.

and Genoa. They founded colonies on the Black Sea, in Asia Minor, and on the Asiatic coast. Venice alone had three thousand merchant vessels. Their commerce was not confined to the borders of the Mediterranean, for the goods of the Orient were distributed by the way of Augsburg and Nuremberg to the interior of Germany and to the towns of the Hanseatic Confederation. Thus commerce was opened with the interior of Europe.

By the failure of the Crusades, the power of the Turks, which had been for the time checked, grew and increased. They conquered the holy places of the earth, Asia Minor and Syria, and finally, crossing into Europe, gained Constantinople. The colonies of Venice and Genoa were captured; their fleets disappeared from the Mediterranean. In western Europe the Spaniards under Ferdinand and Isabella conquered the Moors, who for many ages had occupied the larger portion of Spain; and as the Crescent appeared in eastern Europe, the Cross triumphed in the west.

Spain and Portugal.

Then a new power appeared upon the stage. Spain and Portugal entered upon an era of exploration and discovery in regions unknown to Venice and Genoa. Commerce, which in the Middle Ages had been confined to the Mediterranean Sea, was now extended to the countries on the Atlantic Ocean, and the Cape Verde Islands, Madeira, and the Canaries were discovered. In one generation (between 1470 and 1500 A.D.) more and greater discoveries were made than in any other period of the world's history. The Portuguese sailed along the eastern coast of Africa and rounded the Cape of Good Hope; Vasco de Gama crossed the Indian Ocean to India; Columbus sailed westward to find the Orient, and discovered a New World; Magellan circumnavigated the globe; Balboa crossed the Isthmus of Panama and was the first to see, on the same day, the sun rise out of the Atlantic and set in the Pacific; and soon the eastern and western coasts of America were explored from Newfoundland to Cape Horn and from Cape Horn to Panama.

Both Portugal and Spain claimed all the New World, and as they could not agree upon a division of territory they referred the matter to the pope, who divided the New World between them. The Atlantic became the great highway for commerce, while the Mediterranean was deserted, and Venice and Genoa existed only in the past.

The commerce of Portugal was coextensive with her dominion, which extended from Japan and the Spice Islands and India to the Red Sea, thence to the Cape of Good Hope; and with their possessions on the eastern and western shores of the Atlantic and in Africa and Brazil completed their maritime empire, the most extensive the world has ever seen. Then a single fleet of one hundred and fifty to two hundred and fifty caracks sailed from the port of Goa to Lisbon; now there sails but one vessel a year from all India.

From Spain ships sailed both to the Caribbean Sea and to Cape Horn and thence to Chile and Peru, or directly north-westward from Cape Horn to the Phillippine Islands. Spain conquered Mexico, Central America, and all South America except Brazil. The gold and silver of Peru and Chile and the goods of the Orient were brought to Spain and Portugal. As their wealth and power increased the spirit of exploration decreased, and for nearly two hundred years the Spanish ships sailed in a fixed course by the same lanes, exploring the ocean neither toward the north nor the south, leaving undiscovered the great continent of Australia and numerous groups of islands.

The Spanish and Portuguese leaders were cavaliers who despised all commerce excepting in gold and silver, all kinds of manufactures, all manual labor, and the cultivation of the ground; they came not to colonize, but to satisfy by the labor of the enslaved aborigines their thirst for gold and silver. The whole political power was retained by the king of Spain and administered by Spaniards. While the silver and gold of America and the wealth of the Indies poured into the treasuries of Spain they wanted nothing more. Like ancient Rome, they took all the wealth of the conquered countries, making no return; but they did not, like Rome, give wise and equitable laws and a stable government to the countries they conquered.

The Netherlands.

The inhabitants of the Netherlands were manufacturers, and supplied the markets of Spain and Portugal and their colonies, thus reaping as large profits from their trade with these countries as the Spanish and Portuguese from the mines of gold and silver.

No part of Europe, says Motley, seemed so unlikely to become the home of a great nation as the low country on the north-western coast of the continent, where the great rivers, the Rhine and Scheldt, emptied into the North Sea, and where it was hard to tell whether it was land or water. In this region, outcast of ocean and earth, a little nation wrested from both domains their richest treasures.

The commerce of the Hanseatic towns, which had depended for their trade on Venice and Genoa, became less and less as the glory of those cities waned. Antwerp, with its deep and convenient rivers, stretched its arms to the ocean and caught the golden harvest as it fell from its sister's grasp. No city, except Paris, surpassed it in population, none approached it in splendor. It became the commercial centre and banker of Europe; five thousand merchants daily assembled on its exchange; twenty-five hundred vessels were often seen at once in its harbor, and five hundred daily made their entrance into it. The manufactures of Flanders and the Netherlands had been noted for many generations, and now vastly increased and were distributed all over the world. The Netherlands, though the smallest, became the wealthiest nation of Europe. Then came the long-continued war with Spain, ending in the siege and fall of Antwerp and in the imposition of such taxation as no other country had ever endured. As Antwerp had grown on the ruins of the Hanseatic towns, so her fall became England's gain.

France and England.

In America, north of Mexico, neither silver nor gold had been found to tempt the Spanish and Portuguese. The larger portion of the northern Atlantic coast was one long sand beach, broken by great estuaries and the mouths of great rivers; the rest was rocky and rugged, the temperature generally cold, the land unfertile and barren. For these reasons North America was left to the French and English. The French claimed Canada and the whole of the territory of the United States save a narrow strip of land on the Atlantic coast. The French population was small and was made up principally of fur traders and half-breeds; Great Britain held New England, Virginia, and the Carolinas.

After the first fever of religious colonization had passed, about the commencement of the eighteenth century, there was scarcely any emigration from England to America and but little trade between the two countries. The population of North America was small, its commerce less, with little profit to the European merchants. The country possessed no peculiar advantages for the production of articles of value in foreign markets; there was nothing, therefore, to invite immigration or commerce.

The chief inducement to the English to navigate the Atlantic was the hope of capturing the treasure-laden Spanish galleons and the rich Spanish cities.

Sir Francis Drake, Sir Walter Raleigh, and other navigators, aided by Queen Elizabeth, with bands of buccaneers, refugees from all countries, though mostly Englishmen, explored the recesses of the Caribbean Sea, crossed the Isthmus of Panama, and launched their little vessels on the Pacific. In fifteen years they captured five hundred and forty-five treasure ships, sacked many towns, trained the English seamen, and laid the foundation for the navy of Great Britain.

The growth of English commerce was slower than that of Spain, Portugal or Holland, and it was not until the middle of the eighteenth century, or two hundred and fifty years after the discovery of America, that she entered upon that career which gave her the control of the ocean. Her commerce was built up by protective laws, founded on the Navigation Act of 1651, which prohibited foreign vessels from carrying to or from England the commerce of any country but its own. These laws were universally regarded as among the chief causes and most important bulwarks of the prosperity of Great Britain, and they were con-

tinued until English ships controlled the carrying trade of the world, and were not finally repealed until 1854.

The mechanical devices of Watt, Arkwright, and other great inventors gave to England that supremacy in manufactures which she has ever since retained. The French revolution a little later aroused the fear of the statesmen, merchants, and capitalists of England that the energy of the new republic would be as omnipotent in mercantile affairs as on the field of battle. They believed that France might regain the colonies and with them the commerce she had lost, and therefore England declared war against Napoleon, which was carried on almost continuously from 1793 to 1815. The shipping of the continent disappeared or was captured by the fleets of England; the colonies, and with them the commerce, of Spain and Portugal, Holland and France, passed to England; and though she is still burdened with the debt then created, she has never lost the commerce and carrying trade she then obtained.

The population of the colonies of Great Britain is about one-sixth of the entire population of the globe; and their territory comprises eighty per cent of the available temperate regions of the earth belonging to the Anglo-Saxon race.

The commerce of England has given wealth to her bankers and merchants, and employment to her artisans, ship-builders, iron-workers, miners and manufacturers. Her exports of produce and manufactures have increased five hundred per cent in fifty years, or from $856,000,000 in 1840 to $1,577,000,000 in 1890, and are carried by her ships to every quarter of the globe. Though dependent on America for her food supplies, these are moved in British ships. The commerce of the world pays tribute to the bankers of London and makes that city the money centre of the world. Her best market is India, and from India comes her largest imports; next to these from the United States.

India.

Egypt, Nineveh and Babylon in prehistoric times, Tyre and Sidon and Greece under Alexander, Carthage and Rome under the Cæsars, Venice and Genoa in the middle ages, Portugal and Holland, and lastly England, have drawn great stores of wealth from India.

From India science and literature were handed on to Europe, and from India has come the religion of more than half of the human race. For India the Spanish sailed westward; for India the Portuguese sailed eastward; Portugal was the first to reach the goal and obtain the prize. Greater riches have been drawn from India than from the gold and silver mines of America, since for all ages it has been the storehouse from which treasures were derived. Portugal held India from about 1500 to 1600. Ships brought the silks and precious stones of India to Lisbon, where they were sold to the Dutch and distributed by them through Europe. Spain conquered Portugal, and to avenge herself on Holland excluded her merchants from Lisbon. Then they sailed directly for India, dispossessed the Portuguese, and the commerce of India was for the next hundred years controlled by Holland.

Then for a short time India was divided between France and England, but under Lord Clive and Warren Hastings the possessions of France passed to the East India company, and when their charter expired it was made a province of the crown and the Queen of England became Empress of India.

Unlike Rome and Spain in their dealings with conquered nations, England gives a fair exchange for all she takes, and rules in India for India, giving a more stable and equitable government than India ever before enjoyed.

To-day Tyre, Sidon, and Carthage are known only by their ruins; the glory of Greece and Rome, of Venice and Genoa, has passed; the power of Spain and Portugal has waned, while India is developing a social, moral, and political prosperity, with wealth and commerce unknown in any former period of her history.

Suez Canal.

Much of the trade of India in ancient times passed through a canal connecting the Red Sea with the Mediterranean, the remains of which still exist, and efforts to reopen it have been made at different times by Egypt without success. In 1856 de Lesseps obtained concessions from the khedive for the Suez Canal, and commenced the work under the direction of the best engineers of Europe. De Lesseps applied to English capitalists for help, but they were deterred by Lord Palmerston, who said he "Would oppose the work to the very end." Mr. Stevenson, the engineer, supported Lord Palmerston, declaring that "The scheme was impracticable, except at an expense too great to warrant any expectation of returns." The emperor of France lent his name to the company, and large sums of money were raised in France; but the canal was constructed mainly by the money and laborers of Egypt. It was opened in 1869, and immediately English steamers began to sail through the canal, and the route around the Cape of Good Hope was almost abandoned. Other flags soon followed, and the commerce with India and the east, so long lost to Venice and the ports of the Mediterranean, was revived.

In 1875 Lord Beaconsfield purchased for England a controlling interest in the Suez Canal, and England now rules both Egypt and the canal. The vessels of all the maritime nations of the world are constantly passing through the canal, with the single exception of those of the United States.

Colonies.

The commerce of the great nations of the world has been principally with their colonies or dependencies, and from this commerce they have derived their wealth. The mother country in return for its real or nominal protection, and for its own aggrandizement, has restricted the commerce of her colonies.

The European nations adopted four classes of restrictions:—

1. Restricting the exportation of goods from the colony except to the mother country.

2. Restricting the importation of goods from foreign countries into the colonies.

3. Restricting the exportation or importation of goods excepting in ships of the mother country.

4. Restricting the manufacture even of their own raw products by the colonies. So strong was this feeling in England that even Lord Chatham declared in Parliament, "The British colonies of North America have no right to manufacture even a nail or a horseshoe."

Most of these restrictions have been removed, though the result still remains.

The Phœnicians, Carthaginians, and Greeks had colonies on the Mediterranean. The Romans conquered, and held as subjects, nations and empires. Venice and Genoa had colonies on the Black and Mediterranean seas. Spain and Portugal held as dependencies all Central America, South America, Africa, India, and the islands of the Pacific. The Dutch Republic and France planted colonies in India and America. England has colonies in every part of the world, and on her dominion the sun never sets.

Germany, France, Portugal, and Russia, appreciating the necessity of colonies for the extension of their commerce and for opening new markets for their manufactures, are planting colonies, France in Cochin China, Germany on the eastern and western coasts of Africa and the islands of the Pacific. Portugal, aroused to a new life, is determined to hold her remaining possessions in Africa; Russia is steadily adding to her dominion in Asia, and her railway from the Caspian Sea to Samarcand has opened in western and a part of central Asia a market for her manufactures and commerce hitherto supplied by Great Britain.

United States.

The United States is the only nation that has become great without colonies and without foreign commerce and shipping. Its vast extent of territory, where the east and west, the north and south, are separated more widely than the colonies of Tyre and Sidon or of Carthage and Rome from the mother countries; the great variety of climate, the fertile soil, its varied occupations and manufactures, and a widely distributed population, have created an enormous inland commerce and given that trade and wealth which other countries find in commerce and exchange with their colonies. Our population, wealth, internal commerce, exports and imports have increased at a more rapid rate than

those of any other nation in a similar period. This is not due in any great degree to immigration, for our population has increased in no greater ratio since this immigration commenced than before, and experts believe that it would have been as large and more homogeneous without immigration. We had at one time a large foreign commerce, and our merchants were the first to establish direct trade with China and the East Indies; the Stars and Stripes were seen floating on every sea and flying in every harbor, and for years we were the second maritime nation of the world.

The commerce of the world passed from wooden sailing ships to side-wheel steamers, to iron and then to steel propellers; England was a worker in iron and machinery of every kind, we were not. The civil war came and hastened the day which was sure to come. Our shipping faded away faster than it had arisen, while that of Great Britain increased as rapidly as ours decreased. This was not owing to a decrease of our foreign trade, for during the last twenty years our exports and imports have increased more than twice as rapidly as those of Great Britain.[1] Eighty-seven per cent of these exports and imports are carried in British ships, consigned to English houses which have been established in every large port in the world, and the proceeds are usually remitted to the London banker.

Fortunately, our flag never disappeared from our inland waters and from our coasting trade; for foreigners are excluded from the coasting trade, even where the ports are fifteen thousand miles apart by water.

The substitution of steamers for sailing ships and of steel for wooden propellers, which took place from ten to twenty years ago on the ocean, is now going rapidly on upon our lakes. Where in 1886 there were but six steel propellers, now there are sixty-eight; and of 2,225 vessels on the northern lakes, 1,153 are steamers, 902 are sailing vessels. The action of Congress in providing for the construction and equipment of war vessels by competition has led our ship-builders within the last eight years to establish ship-yards and machine shops where the largest ships can be built, and we are now building as large and fast vessels of war as England. Our ship-builders claim that they can construct ships equal in carrying capacity, speed and strength to those of Great Britain, and at no greater cost; though they cannot be run so cheaply because our sailors are better housed, fed and paid than those of other nations. The day will surely come when commerce will make her last movement westward, when America, lying between Europe and Asia, with her boundless mineral and agricultural resources, her manufacturing facilities, her extended sea-coasts, will be the foremost nation and New York the commercial capital of the world.

Nicaragua Canal.

From New York to San Francisco by land is about 3,000 miles, by water it is about 15,000 miles; yet, notwithstanding the greater distance, freight is constantly sent by water. From San Francisco it is about the same distance by water to either New York or London. If a waterway could be opened across the isthmus of Panama from one ocean to the other, the distance from New York to San Francisco would be diminished more than one-half, and San Francisco would be over 2,000 miles nearer New York than London. The first proposition for canals connecting the two oceans was made in 1550, suggesting two routes, by Panama and Nicaragua; and explorations and surveys of both have been frequently made, and various attempts made for their construction.

The success of the Suez Canal induced M. de Lesseps to undertake the connection of the two oceans by the construction of the Panama Canal, believing that the tonnage passing through it would equal that of the Suez Canal. This work has not been successful; the canal remains unfinished, with no prospects of completion.

Several hundred miles north of Panama is the lowest continental divide; 148 feet above tide-water on the Pacific slope of this divide is Lake Nicaragua, connected by the river San Juan with the Atlantic; up this river and through this lake, some thirty years ago, was one of the regular ways of intercommunication, both for freight and passengers, between New York and California.

The Maritime Canal Company and the Canal Construction Company, organized by Americans, have obtained concessions from Nicaragua, and have made surveys for canal, slack-water, and lake navigation from Greytown on the Atlantic through Lake Nicaragua to Brito on the Pacific, a distance of 170 miles. A harbor has been opened at Greytown and considerable work performed on the canal. The Panama route had the great advantage of an open channel from ocean to ocean, whereas the Nicaragua route requires several locks to cross the divide; but Brito is some six or seven hundred miles nearer California than Panama, a saving in distance that will compensate for the delay in locking. The opening of this canal will be the greatest benefit that could be conferred upon our commerce and shipping.

Freights by water between New York and California are now so high that a large portion goes by railroad. The effect that this canal should produce will be evident if we consider the great difference in expense between land and water carriage. Rail rates between New York and Chicago are a trifle over six mills per ton per mile, while the ocean rates on grain to Liverpool in 1888 were about half a mill per ton per mile; and one mill per ton per mile, or three dollars per ton from New York to Liverpool, is said to be a fair rate, while the all-rail rate between New York and San Francisco averages from forty to eighty dollars per ton, according to the class to which the freight belongs. It takes from seven to ten days to go from New York to Liverpool, twice as long from New York to San Francisco by rail, thirty days by Panama, and one hundred and twenty days by the all-water route around Cape Horn.

The opening of this canal will therefore reduce the freight on goods between the east and west at least three fourths and possibly more. It will give us a free, easy, and cheap communication by water between the Eastern and Western States; our commerce will be built up, and the wealth and commerce of the Atlantic coast and the population of the States on the Pacific coast will be increased in a wonderful manner.

The opening of this route will give a demand for large steamships, and when we have such ships large ship-yards and machine-shops will spring up, and these alone are wanted to enable us to build and run ships on the Atlantic Ocean in competition with Great Britain. Then the prediction of Mr. Cramp will be fulfilled, that Englishmen will be asking one another, "Can we build ships as economically as they do in the United States?"

Modes of Conveyance.

The earliest transportation of merchandise was by caravans. The first caravan of which we have any certain account was that of the Ishmaelites and Moabites, who, while they were travelling from Gilead with their camels, bearing spices, balm, and myrrh to Egypt, bought Joseph of his brethren and sold him as a slave to Potiphar. These caravans were formed of merchants banded together for protection, under a guide and leader, sometimes numbering several hundred, with one thousand camels in a caravan. They travelled from seventeen to twenty miles a day, but only in the spring and autumn months. At night they stopped at caravansaries, where free lodging was furnished to men and beasts. In Turkistan and Arabia all trade and travel was by similar caravans until the railroad was opened across the desert by Merv and the Oxus to Samarcand.

Navigation was first by boat, and ages afterward by vessels. The earliest vessels of which we have any account were employed in carrying cattle down the Nile, and were propelled by sails and rowers. The vessels, at first small and with few rowers, were slowly increased in size and number of rowers until three, four, and even five banks of oars, one over the other, were used. They were often from 150 to 175 feet long, and from 18 to 26 feet in breadth, drawing from 10 to 12 feet of water, and sometimes carrying two hundred rowers and several hundred men. All these ships were without decks, whether sailing on the Mediterranean

[1] The exports of the United States have increased 112 per cent, the exports and imports 92 per cent; the exports of Great Britain 35 per cent, her exports and imports 37 per cent.

or Atlantic. They sailed by day, putting into harbor at night, and never losing sight of land unless driven by stress of weather. At first they sailed only with the wind, but by slow degrees they learned to tack; then decks were built over the stern and prow, leaving the mid-ships exposed to the high seas. This class of vessels, sometimes with banks of oars, continued until the middle of the last century. In the early part of the fifteenth century smaller but stronger vessels of better material were built for the voyages of discovery undertaken by the Portuguese. At this time also the mariner's compass was brought into general use, having been introduced from Arabia; eighty years later it found its way to England. Two of the vessels of Columbus were decked only at the prow and stern, and the three were manned by one hundred and twenty men.

The Armada of Queen Elizabeth was formed of merchant vessels fitted up as men of war, and not until the time of Charles the First were there any regular ships of war in England or, probably, in other countries.

Commerce was usually carried on by companies, with rules regulating the quantity of goods to be exported, so that the market should not be overstocked and unremunerative prices obtained. Sometimes the merchant was owner of the vessel, who adventured with his cargo and sailed in his own ship. The ships were constructed with little reference to speed, sailing forty or fifty miles a day.[1]

The steam engine came into use near the middle of the eighteenth century in England, and two generations passed before it was used on vessels. The first steamboat ran on the Hudson in 1807, in England in 1812. Then another generation passed before the ocean was crossed by the "Sirius" and "Great Western" in 1838. These ships sailed from seven to eight knots an hour. Ten years later iron ships were built; then came the propeller, the invention of Ericsson, followed by vessels built of steel, and lastly the "City of Paris" and "Majestic," carrying fifteen thousand tons of freight and sailing five hundred knots a day, or twenty knots an hour.

Until the present century all commerce between remote points was by water, excepting in the Roman Empire. After the downfall of Rome there was neither commerce nor travel and no use for roads, the cost of transportation even for a short distance exceeding the value of the goods.

The railroad was introduced about the same time into England and America, and was rapidly extended into every country. The steam-engine on land and water has revolutionized the methods of transportation and created a new commerce. "The movement of goods in a year on all the through routes of the world did not then equal the movement on a single one of our trunk lines of railroad for the same period." Formerly it cost ten dollars to move a ton of freight one hundred miles; now it can be moved thirteen hundred miles for the same sum. The grain and corn from our western lands, then not worth the transportation to the sea coast, are now sold in London, and our prairies yield to the western farmer greater profit than the grain lands of England yield to the farmer there. The land commerce created by steam probably exceeds to-day the commerce carried on the water.

The cost of moving freight by railroads varies greatly in different parts of the United States and in different countries. The highest cost west of the Rocky Mountains is two and a quarter times more than in some of our middle States. The average freight receipts per ton per mile in this country is $0.922, which is less than those of any other country, although the Belgian and Russian rates are not much higher. In England the rates are from fifty to seventy per cent higher than in America, and in the other countries of Europe higher than in England.

In England and America the railroads are operated by private companies in competition.

In France railroads are operated by private companies regulated by law, the country being divided among different lines of road. Lines are constructed by private companies and run at rates fixed by the government.

[1] The breadth was about one-fourth the length, and not until within forty years were the proportions of one-tenth or one-twelfth of the breadth obtained.

In Belgium and Germany the principal roads are owned and operated by the government.

Our system has yielded the best results to the people.

The commerce which was in olden times transported only twenty or twenty-five miles a day is now moved five hundred miles a day by water and eight hundred miles by land. Correspondence, then carried no faster than freight, is now borne by telegraph to the farthest ends of the world.

All these changes have taken place within a single generation; for our fathers could not travel any faster than Alexander or Cæsar. Steamships, railroads, and telegraphs within that time have transformed all commercial transactions and the methods of commercial business. Formerly eight months were required to execute an order in India or China and obtain the return; now one day is sufficient. These commercial changes caused a revolution in the modes of business, and were the main factors which produced the monetary disturbances of 1873, the effects of which we yet feel, so long has it taken the world to adjust itself to its new relations.

The Future of Commerce.

The commerce of the world originated in Asia; it was carried to Africa and thence to Europe, and from Europe to America. This movement can go no further westward, for on the other side of the Pacific is China, which has successfully resisted every attempt of the European to encroach upon her domains, and India with its teeming population of two hundred and fifty millions; so that America, the last of the continents to be inhabited, now receives the wealth of India and Asia pouring into it from the west, and the manufactures and population of Europe from the east. Here the East and West, different from each other in mental power and civilization, will meet, each alone incomplete, each essential to the fullest and most symmetrical development of the other. Here will be the great banking and commercial houses of the world, the centre of business, wealth, and population.

The end is not yet. Inventions are increasing in a geometric rather than an arithmetic progression. The limit of steam-power has not been reached, for with a high temperature in the steam-boiler the addition of a few pounds of coal increases the steam-power so greatly that we are unable either to control or to use it.

Electricity has just begun to offer new opportunities to commerce. We are no longer compelled to carry our factories to the water-power, for by the electric wire the power may be brought to the house of the operative, and we may again see the private workman supercede the factory operative. A few cars and small vessels are moved by electricity — the forerunner of greater things. We know little of this new agency, but its future growth must be more rapid and more wonderful than that of steam.

The secretary of the Smithsonian Institution (Mr. Langley) tells us that "before the incoming of the twentieth century, aerial navigation will be an established fact."

"The deeper the insight we obtain into the mysterious workings of nature's forces," says Siemens, "the more we are convinced that we are still standing in the vestibule of science; that an unexplored world still lies before us; and, however much we may discover, we know not whether mankind will ever arrive at a full knowledge of nature."

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

The Loup Rivers of Nebraska.

PERCEIVING by Professor Hicks's reply (March 4) to my comment (Feb. 19) on his essay on the Evolution of the Loup Rivers (Jan. 29) that I had in part misapprehended his meaning, I have corresponded with him in order to understand more clearly the share that he ascribes to headwater erosion and capture in the development of the present stream courses. As is not infrequently

the case, there is more agreement than difference in our discussion.

My misapprehension arose as follows: In his essay of Jan 29, after speaking of headwater erosion and the subsequent capture or lateral abstraction of certain streams by this process, Professor Hicks wrote, "The latest robbery in the Loup system is that of the headwaters of the Wood River. Journeying down from the headwaters of the South Loup, one is impressed with the apparent continuity of its valley with that of Wood River, rather than with that of the South Loup itself below Callaway. It is obviously an instance of the lower, more easterly stream cutting through the divide and drawing to itself the headwaters of the higher one. This series of captures by lower tributaries is exhibited on a grand scale and in a mature form in the Loup system."

If the reader will refer to the first figure in Professor Hicks's essay, he may understand why I inferred from this sentence that the several other deflected streams, exhibiting the same relative parts as shown in the South Loup and Wood Rivers, constituted the "series of captures" in which the South Loup was "the latest robbery."

It now appears, however, that the head of Wood River was not precisely located in the figure referred to; and that its correction by Professor Hicks in his letter to me places it more as figured by Professor Todd in *Science* for March 11. As thus figured, it is distinctly placed in another category from the streams deflected eastward by flood-plaining.

Professor Hicks refers me to his article on "An Old Lake Bottom" in the second volume of the Bulletin of the Geological Society of America. Mention is there made of certain old valleys of Tertiary erosion, more or less obscured but not entirely concealed by lake sediments of later Tertiary deposition, by which the country is now covered. These old valleys are placed in the same category with the abandoned channel at the head of the Wood River, by which the South Loup is supposed once to have flowed to the Wood, as if headwater erosion by adjacent streams had in all these cases determined the abandonment of the old valleys. But it is still not clear why all these abandoned valleys must be regarded as having lost their former streams by lateral abstraction following headwater erosion. I perceive that the slopes indicated in Professor Hicks's figures are in the proper direction for such abstraction; but it is surprising to find that slopes of so moderate a measure of inclination suffice to give one stream an advantage over another, even to the points of abstraction of this kind. I shall be delighted if this is proved to be the case; for, if so, the process of abstraction and the accompanying rearrangement of divides may be regarded as of very extensive application. As ordinarily explained, the advantage that the capturing stream must possess is much greater than would be found in a region of horizontal and comparatively weak sediments, and of moderate inclination, such as Nebraska.

I shall therefore hope to have a fuller discussion of the problem from Professor Hicks, and an exclusion of other processes as well as a confirmation of the effective action of headwater erosion on so large a scale in producing these changes in Nebraska river courses.

The chief rearrangement of the Loup streams, as shown in Professor Hicks's diagram, being the product of down-stream deflection of the tributaries of a flood-plained river, I find in them a very satisfactory justification of a somewhat hazardous explanation offered in an essay on the Rivers and Valleys of Pennsylvania (Nat. Geogr. Mag., I., 1889, 241) for the down-stream deflection of certain tributaries of the Susquehanna in the central portion of the State. But in this case the flood-plain, by whose growth the tributaries were deflected, is a thing of the imagination. If it ever existed, it has been entirely worn away by the denudation following the later elevation of the region in Tertiary time; the deflected streams, maintaining their specialized courses after uplift, cut down their channel through the imagined flood-plain sediments, and thus became superimposed on the underlying strata which they now deeply dissect and traverse in a highly inconsequent manner. Professor Todd's diagram gives further illustration of this kind of down-stream deflection of tributaries. All of the branches of the Platte are deflected before reaching the main stream; the Platte itself is turned down before joining the Missouri; so is the Niobrara.

In this connection I wish to suggest another cause besides the three mentioned by Professor Todd for the north-eastward turn of the Platte at Kearney; namely, the possible spontaneous deflection of the river from its previous more direct course, as, for example, along the Little Blue, by its own action in building up the plain over which it flowed. The rivers of the plains of India frequently change their courses in this fashion; the Hwang-ho devastates the plains of China for the same reason. May not the Platte have once had the same shifty habit? The Garonne, in south-western France, is a still more striking example of a spontaneous avoidance of its former course. Much of the waste borne out from the Pyrenees by the Garonne and its fellows now forms a flat, delta-like surface, of radial slope from the point where the larger rivers issue from the mountains; but, instead of pursuing a direct course northward, the Garonne turns sharply to the east at the foot of the mountains; while numerous small streams run down the slope of the radial alluvial deposit. Perhaps in the same way the Little Blue and the branches of the Big Blue Rivers may represent the old courses of the Platte, abandoned for a newer course of lower grade.

There are two other questions that I should like to ask of western observers. Is there generally perceptible a right-handed deflection of the rivers on the plains, as if in consequence of the earth's rotation? Can examples be given of the lateral abstraction of one stream by another on a slope of planation, after the fashion described by Gilbert in his report on the Henry Mountains some years ago?

W. M. DAVIS.

Cambridge, Mass., April 7.

The Persistency of Family Traits.

THERE are one or two points bearing on the subject at the head of this article that were not mentioned by either of the writers in the issue of March 18. The first is that the mother in placental mammals tends to assimilate in respect to blood to the father, as the blood of the mother passes through the young *in utero* and therefore the strain of blood derived from the father is shared by the young with the mother. A study of family history carried on for almost twenty-five years shows that there is generally a running to what are called "family types" among the youngest of a numerous family, and the type is that of the paternal family. It is too well known to need argument that the mother frequently acquires diseases belonging to the father indirectly through the child she is carrying. It is also well known that an old couple tend to assimilate in facial and bodily appearance, and the change, as shown by numerous instances, is generally in the female, as the above facts would call for. We can see that each child in a family finds the mother more and more impregnated with the blood of the paternal house, and it is not strange if the children favor the family that gives them the name.

The other fact is that the pregnant mother is more readily influenced by whims than in any other state. From classical times to the present it has been the aim of those about a woman in such a state to make life as pleasant as possible. While we may no onger surround her with beautiful statues and other paraphernalia of a Roman household, we recognize that her whims may fix the character as well as permanently mark the coming child. We drive a gravid mare in a light wagon that the foal may be amenable to discipline. As the generality of married people associate more with the family that carries the name, it follows that the mother is affected by sympathy or antipathy for that family, and both lead her to dwell on the features and forms of its members, so that the child runs a good chance of bearing either or both. Birth-marks do not exist in fiction only, and though the bloody horse-shoe of Redgauntlet may be lacking, there are other signs to show the horror or antipathy of a terrified or whimsical mother. In a love match, the face of the father is reproduced, or, as the French proverb says, "The love child resembles the father." A union, therefore, of the two conditions noted above will cause the children to favor the race that carries the name rather than to run toward the spinster side, even were there nothing like reversions

to the primitive type, and as family portraits show a uniformity that could not exist if the race obtained but its mathematical proportion of ancestral peculiarities. arguments based on the mathematics of the case avail little in the discussion.

EDWARD H. WILLIAMS, JUN.

Bethlehem, Penn., April 9.

BOOK-REVIEWS.

The Great Earthquake of Japan, 1891. By PROFESSOR JOHN MILNE, F.R.S., and PROFESSOR W. K. BURTON, C.E. With plates, by K. Ogawa. Yokohama, 1892.

IN these modern days when photography has assumed such an important part, not only in the artistic side of life, but in the work of scientific observation as well, it was inevitable that after any great natural occurrence like the Japanese earthquake of October, 1891, the camera should be employed to assist in preserving a correct record of its effects. Some of the pictures so taken have been reproduced in the European and American illustrated papers and have aided much in conveying to western readers an idea of the great destruction caused by this calamity; but none which the writer has seen can be compared to the beautiful series of pictures contained in the volume named above.

It is an oblong quarto, 29 cm. by 41 cm. in size, containing twenty-nine full-page heliotype copies of photographs and one map. All but three of the photographs were made by the authors for the Imperial University of Japan, and are copyrighted in its name. They are printed on a fine Japanese paper, which is itself a product of the very district shaken by the earthquake. The book is published by Lane Crawford & Co., Yokohama, but the press-work was done in Tokyo. It is prepared as a popular souvenir of the earthquake, and makes no attempt at any scientific discussion of the phenomena, the ten pages of introductory letter-press on earthquakes in general and the short explanation attached to each plate being mainly descriptive.

In nearly one-third of the plates the objects illustrated are the temporary shelters to which the inhabitants were driven. But in those which illustrate the ruined condition of the buildings and bridges, the excellent plates give such perfect details that many points of scientific interest can be seen and studied. This is especially true of the series of five views of the Nagara iron railroad bridge. This bridge consisted of five two hundred-foot spans of trussed girders, of which one span fell entire into the river's bed, carrying down with it one end of each of the adjoining spans, yet the pictures make plain that the girders themselves were so well put together that they are but little injured by their fall. Another view shows the approach to this bridge, where the embankment has entirely sunk away, leaving the rails and ties eighteen feet up in the air. At another place where the rails have been distorted into a serpentine form, the photograph shows three distinct horizontal flexures in which the rails are at least two feet out of their alignment. Other views again illustrate the crevasses, often several feet wide, by which the ground was riven, especially

CALENDAR OF SOCIETIES.

Philosophical Society, Washington.

April 9.—W. J. McGee, Illustrations of Isostatic Pressure; Bailey Willis, Illustrations of Appalachian Structure (with lantern views); Robert T. Hill, The Geologic Evolution of the Topography of Texas (with lantern views).

Geographical Club, Philadelphia.

April 6.—Henry Pettit, The Orient and the Occident.

Contemporary Club, Philadelphia.

April 12.—Frank Hamilton Cushing, Zuni Folk-Lore.

Oriental Club, Philadelphia.

April 14. — Rev. Dr. Marcus Tastion, Psalms 24th, 78d, and 90th; Talcott Williams, Note on Arab Geography.

Numismatic and Antiquarian Society, Philadelphia.

April 7. — Inman Horner, Lieutenant Gorger's Notes on Alaskan Indians. Exhibition Alaskan Objects.

Publications Received at Editor's Office.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Transactions, Vol. VII. New York, The Institute. 8°. 647 p.

DAVIES, CHARLES. New Elementary Algebra. Edited by J. H. Van Amringe. New York, American Book Co. 12°. 294 p. 90 cts.

FERREE, BARR. Christian Thought in Architecture. New York, from the Proceedings of the American Society of Church History. 8°, paper. 32 p.

KELLER, HELEN. Souvenir of the First Summer Meeting of the American Association to Promote the Teaching of Speech to the Deaf. 2nd ed. Washington, Volta Bureau. 4°, paper.

NATURAL SCIENCE. Vol I., No. 1., March, 1892. London and New York, Macmillan & Co. Monthly. 8°. 80 p.

NEWALL, JANE H. Outlines of Lessons in Botany. Part II.: Flower and Fruit. Boston, Ginn & Co. 12°. 396 p. Ill.

PARSONS, JAMES RUSSELL, JR. French Schools through American Eyes. Syracuse, C. W. Bardeen. 8° 186 p. $1.

PHILLIPS, MORRIS. Abroad and at Home. New York, Brentanos. 12°. 251 p.

SMITHSONIAN INSTITUTION. Annual Report of the Board of Regents to July, 1890. 8°. 842 p. Washington, Government.

along the embankments of the rivers, and others the ruins of the cotton spinning mill at Nagoya.

Altogether this album of plates is a most valuable contribution to the history of the earthquake, and may well merit a place on the shelves of anyone interested in Seismology. The first edition of 1,000 copies has all been sold at 6 yen (about $4.50), which is a very low price for such a volume; and a second edition is in preparation, perhaps ready for issue by this time. This will contain one or two additional plates, and will be sold at a somewhat higher price.

C. G. R.

Princeton, April 9.

AMONG THE PUBLISHERS.

EDGERTON CASTLE'S important work on "Schools and Masters of Fence," which has heretofore only been obtainable in an expensive 4to form, will shortly be issued by Macmillan & Co. as a volume in the Bohn Library. The reprint will contain all the original illustrations and some additions in matter over the original work.

— G. P. Putnam's Sons add to their previous announcements the following: "Materialism and the Modern Physiology of the Nervous system," by William H. Thomson, M.D., professor of Materia Medica and Diseases of the Nervous System in the Medical College of New York. This volume, which will be illustrated, comprises the material (revised, with some additions) of two lectures recently delivered by the author before Columbia College, and at the McGill University, Montreal. Professor Freeman, whose sudden death a fortnight back has caused to be left unfinished a good deal of important literary work, had just before his death completed the proof-reading of the last pages of "The Story of Sicily," which he had prepared for the *Story of the Nations Series*. The preface to the volume, which he had not completed, will now probably be written by his son-in-law, Professor Arthur Evans.

SCIENCE

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

PUBLISHED BY N. D. C. HODGES, 874 BROADWAY, NEW YORK.

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SCIENCE

NEW YORK, APRIL 22, 1892.

THE LOAN COLLECTION OF OBJECTS USED IN WORSHIP.

THE ceremonies at the opening of the Loan Collection of Objects used in Worship at the Museum of Archæology of the University of Pennsylvania took place on the afternoon of the 16th of April, in the large hall of the library building, in the presence of a large audience of invited guests and members of the University Archæological Association. Addresses were made by Dr. William Pepper, provost of the University, the Rev. John S. MacIntosh, D.D., LL.D., the Rev. Dr. Marcus Jastrow, and Mr. Charlemagne Tower, president of the Department of Archæology. Dr. MacIntosh, in his address entitled "Musings in the Pantheon of the East," dwelt upon the evidences of the unity of the human race to be found in the various religions represented in the collection. Dr. Jastrow, in conclusion, said, "Few in number as yet are the universities which have endowed chairs for the history of religions; a beginning has been inaugurated by which to interest American thought in this special work. Collections of religious emblems like the one we are about to open to-day contain the way-marks on the roads and by-ways which the human family has been taking up to this day. As yet there exists in the world only one museum where these way-marks can be studied; it is the Musée Guimet in Paris. And our collection here is the first attempt of the kind in our country."

The collection is divided into sections, each of which was either arranged and described by a special student, or by the curator with the aid of native oriental scholars. Each section of the catalogue, a closely-printed octavo of 174 pages, is prefaced by a sketch of the religion to which it refers, while the details regarding each object comprised in the 794 catalogue entries are given in appended notes. The sections comprise Religions of Ancient Egypt, by Mrs. Cornelius Stevenson; Religions of India: Vedism, Brahmanism, Buddhism, and Jainism, to which Suamee Bhaskara Nand Saraswatee of Jodhpur lent valuable assistance; Religions of China, divided into the State Religion, Confucianism, Worship of Ancestors, Taoism, Buddhism, and Thibetan Buddhism, arranged with the aid of scholarly Chinese; The Religion of the Chinese in the United States, under which is to be found an almost complete collection of the idols, shrines, amulets, implements for divination, with incense, paper money, and offerings used by our Chinese residents, including two practical shrines with all of their appurtenances, one of the God of War and the other the shrine erected at the New-Year; Religions of Japan: Shintoism and Buddhism, collated with the aid of resident Japanese students; Mohammedanism, by Dr. Morris Jastrow, professor of Arabic in the University of Pennsylvania; Native American Religions, comprising the North-west Coast, United States, Mexico, Yucatan, San Domingo, and Peru, by Dr. Daniel G. Brinton; Religions of Polynesia, by Dr. Brinton; Religions of the Baulu Tribes of Africa, by Rev. Dr. Robert Hamill Nassau; and, in conclusion, a section devoted to charms and amulets.

The collection represents forty-five individual donors and lenders, besides several institutions and societies, including the Smithsonian Institution, Washington, D.C., the Numismatic and Antiquarian Society of Philadelphia, and the Board of Foreign Missions of the Presbyterian Church in the United States, whose Missionary Museum constitutes the nucleus of the exhibition. The plan of the Musée Guimet has in general been followed, but the collection has a much wider range than the great Paris museum, although inferior to it in point of intrinsic value and artistic beauty of the specimens, every object in the Guimet Museum being a gem.

The educational value of the collection has been the first thing considered, and whatever are its deficiencies, it is highly suggestive throughout, and an endeavor has been made to supply the notable gaps by means of notes in the catalogue.

The exhibition has been the means of bringing to light many objects of scientific importance, whose possessors were unaware of their significance and value, and making them available for the purposes of study. It marks an event in the history of scientific work in its special field in Philadelphia, where the study of the history of religions, the object of a highly successful course of lectures during the past winter under the auspices of the University Archæological Association, has lately received much attention.

THE BROOKLYN INSTITUTE BIOLOGICAL LABORATORY.

THE location of the Biological Laboratory, at the head of Cold Spring Harbor, is one of the most favorable on the coast. The country around is high and rolling, with abundant forests, glens, and small streams, affording most excellent hunting ground for every form of animal and vegetable life common to our climate. Just above the laboratory is a series of three fresh-water ponds, each fertile in its own peculiar forms of fresh-water life, and through which flows the water of Cold Spring Creek. Just below the Laboratory is the harbor of Cold Spring, divided by a sandy neck into an inner and an outer basin. These basins afford a great variety of marine life, and the channel between the inner and outer basins has a varied and vigorous growth of algæ, molluscs, and echinoderms. The outer basin has shallow flats, banks, and eel grass, sheltered pools, oyster-beds, and other favorable conditions for collection and study. The outer basin opens widely into Long Island Sound, whose coast is exceedingly varied in character for twenty miles in either direction.

The main Laboratory occupies the first floor of the New York State Fish Commission Building, and is a room thirty-six feet wide and sixty-five feet long, provided with ample light from every side. It is furnished with laboratory tables, aquaria, hatching-troughs, glassware, and all the apparatus and appliances required for general biological work. Into the Laboratory is conveyed a bountiful supply of the water

of the Cold Spring for use in the aquaria and troughs. This water is pure, has the same low temperature throughout the year, and is the water used so successfully by the New York State Fish Commission in hatching and growing salmon, trout, and other food fishes. The Laboratory is also supplied with an abundance of salt-water, which is pumped up from the harbor into a reservoir, from which it runs into the Laboratory.

The station is provided with two small row-boats and a naphtha launch, together with nets, trawls, and dredges for use in collecting and dredging. The main Laboratory is furnished with both fresh and salt-water aquaria, with a Becker microtome and a Minot microtome, together with many smaller instruments and appliances. Near the main Laboratory is a photographic room, with a dark room and a work-room adjoining. These rooms are provided with a general photographic outfit, a photomicrographic apparatus, a heliostat, and the necessary appliances for practical photography.

Each student is provided with dissecting instruments, chemicals, and glassware to be used in the dissection, preparation, and study of tissues. Students who own microscopes, or who can borrow them for the summer, are respectfully requested to bring them to the Laboratory for their own individual use. Microscopes will be provided for those students who cannot provide themselves with instruments.

The New York Fish Commission very kindly grants the use of the main Laboratory room for biological study during the summer months, when it is not required by the work of the Commission.

The other buildings and the grounds used by the Biological Laboratory are the property of the Wauwepec Scientific Society of Cold Spring Harbor, and the use of them is generously donated by the Society for the benefit of the instructors, specialists, and students who are in attendance at the Laboratory.

A general course in biology adapted to meet the wants of those who desire to obtain a general and working knowledge of biology either for use in teaching or in preparation for special work will be given during the first six weeks of the session. It will consist primarily of laboratory study of specimens illustrating leading types of animal life. The practical work will be accompanied by lectures giving an outline of systematic zoology, for the purpose of showing the relations of the forms studied to other animals. The lectures will also touch upon various matters of general biological interest. The types studied will comprise forms of life represented in the waters of Long Island Sound.

Accompanying this course of laboratory work and lectures, instruction will be given in methods of mounting objects and in the preparation of microscopic sections. Opportunity will also be given for collecting and surface skimming.

A special feature of the Laboratory will be an extended course in the methods of bacteriological research. The course will consist of laboratory work on the culture and propagation of bacteria, the identification of species, and of lectures and demonstrations by the director. The number of students admitted to this course is limited, and only those who are well prepared by previous study and experience in biological or medical work will be admitted to the course.

Students who pursue the general course of instruction during the summer, and who have time for extra work, are given the instruction and facilities necessary to enable them to carry on special investigations, while those students who have already gained the knowledge and experience which is provided by the general course, will be permitted to give their entire time to special work. No special courses will be laid down in advance, but each student will be at liberty to arrange with the director of the Laboratory for such a course or courses as may be practicable.

Each lecturer will be provided with extra laboratory space in which to carry on his own private investigations so long as he shall remain at the Laboratory, and will not be called upon to give any instruction outside of his lectures and such directions for work as may accompany his lectures.

The Laboratory will open for the season on Wednesday, July 6. The regular session for students will continue from that date until Wednesday, Aug. 31.

The tuition fees will be, — for the full term, eight weeks, $25; for the first six weeks, $20; for the first four weeks, $15; for the last four weeks, $15.

The tuition is payable $10 on registration as a student, and the balance during the first week of attendance. Each student will be entitled to attend all the lectures delivered at the Laboratory, to the use of the Laboratory and its appliances, subject to the regulations established by the director and board of managers, and to all the facilities for collecting specimens which are possible with the launch and other boats provided by the Laboratory.

The number of students for the season of 1892 is limited to thirty. The Board of Managers reserve the right to admit as students only those whose training qualifies them to make the best use of the Laboratory and its facilities for study and research. Applicants for admission to the Laboratory should state what work in botany or zoology they have already done, and what course they would like to pursue the present season.

A good reference library will be placed at the service of students, and a collection of algæ will serve to guide students in marine botany. In addition to the regular lectures given in connection with the laboratory work, evening lectures will occur two or three times a week, illustrated by the aid of a magic lantern. The lantern is provided with a vertical attachment and with large and small cells, in which forms of life may be placed and their structure exhibited on the screen. A microscopic attachment to the lantern will enable lecturers to demonstrate points in minute anatomy, and a large collection of lantern slides of biological subjects will furnish the means for comparison of many allied forms and structures.

The evening lectures will be open to the public, and persons interested may secure admission to the entire course.

Arrangements have been made with residents at Cold Spring Harbor to provide very good and comfortable rooms, with board, a few minutes' walk from the laboratory, at rates varying between six and eight dollars per week.

A new dining-room has been provided close by the Laboratory, and excellent board will be provided to such officers and students as may choose to avail themselves of it at $5 per week. It is expected that a majority of the officers and students will board at the dining-room and take rooms at the residences near by. The expense in this case will be as before, between seven and ten dollars for board and room.

Accommodations can be secured at either of the large, excellent, and quiet hotels that overlook the harbor, and are fifteen minutes' ride by boat or carriage from the Laboratory, at rates varying between eight and fifteen dollars per week, according to the size and location of rooms. The hotels are known as the Glenada, Laurelton, and Forest Lawn.

Full information will be given concerning rooms and board to anyone who signifies an intention of becoming a

student at the laboratory, and both board and room may be engaged in advance by application to the director of the Laboratory.

For further particulars inquire of Professor Franklin W. Hooper, Brooklyn Institute of Arts and Sciences, N.Y., or of Professor Herbert W. Conn, Wesleyan University, Middletown, Conn. Applications for admission as students should be sent to the Institute.

THE MARINE BIOLOGICAL LABORATORY.

THE corps of instructors this year consists of Dr. C. O. Whitman, director, professor of zoology, Clark University; editor of the *Journal of Morphology;* H. C. Bumpus, associate professor of zoology, Brown University; E. G. Conklin, professor of biology, Ohio Wesleyan University; Pierre A. Fish, instructor in physiology and anatomy, Cornell University; Jacques Loeb, professor of physiology, Bryn Mawr College; W. A. Setchell, instructor in botany, Yale University; Sho Watase, assistant in animal morphology, Clark University; W. M. Wheeler, assistant in animal morphology, Clark University; Ryoiche Takano, artist; G. M. Gray, laboratory assistant; J. J. Veeder, collector.

In addition to the regular courses of instruction in zoology, botany, and microscopical technique, consisting of lectures and laboratory work under the direct and constant supervision of the instructors, there will be a number of lectures on special subjects by members of the staff. A course of lectures in embryology will be given by Professor Whitman; in biological physiology, by Dr. Loeb; and two or more courses in invertebrate zoology, by Dr. Bumpus and Dr. Wheeler.

There will also be ten or more evening lectures on biological subjects of general interest. Among those who may contribute these lectures and take part in the discussions upon them may be mentioned, in addition to the instructors above named, the following: Dr. H. Ayers of the Lake Laboratory; Professor H. H. Donaldson, Clark University; Professor William Libbey, Jun., Princeton College; Dr. Warren P. Lombard, Clark University; Professor Charles Sedgwick Minot, Harvard Medical School; Professor E. S. Morse, Salem; Professor H. F. Osborn, Columbia College; Professor W. T. Sedgwick, Massachusetts Institute of Technology; Professor E. B. Wilson, Columbia College.

The Laboratory is located on the coast at Wood's Holl, Mass., near the Laboratories of the United States Fish Commission. The building consists of two stories — the lower for the use of teachers and students receiving instruction, the upper exclusively for investigators. The Laboratory has aquaria supplied with running sea-water, boats, a steam launch, collecting apparatus, and dredges; it is also supplied with reagents, glassware, and a limited number of microtomes and microscopes. By the munificence of friends the library will be provided henceforth not only with the ordinary text-books and works of reference, but also with the more important journals of zoology and botany, some of them in complete series.

The Laboratory for investigators will be open from June 1 to Aug. 30. It will be fully equipped with aquaria, glassware, reagents, etc., but microscopes will not be provided. In this department there are twenty-four private laboratories supplied with aquaria, running water, etc., for the exclusive use of investigators.

Owing to the growth of the Laboratory and the great demand for tables, the trustees have voted to enlarge the present building so that a spacious new wing will be ready for use on July 1. Those who are prepared to begin original work, but require supervision, will occupy tables in the general laboratory for investigators, paying for the privilege a fee of fifty dollars. The number of such tables is limited to ten. An elementary course in investigation will be introduced this season, designed to meet the needs of those who have completed the general courses in the Students' Laboratory. Definite problems of limited scope will be assigned and worked out as a means of training in the ways and methods of research. The fee for this course also will be fifty dollars, and the number of tables will likewise be limited to ten. For the completion of any considerable piece of investigation, beginners usually require from one to three full years. It is not expected, therefore, that the holders of these tables will finish their work in a single season. The aim is rather to make a secure beginning, which will lead to good results if followed up between sessions, and renewed, if need be, for several successive years.

The Laboratory for teachers and students will be opened on Wednesday, July 6, for regular courses of seven weeks in zoology, botany, and microscopical technique. The number admitted to this department will be limited to fifty, and preference will be given to teachers and others already qualified. By permission of the director, students may begin their individual work as early as June 15 without extra charge, but the regular courses of instruction will not begin before July 6. Though more advanced students who may wish to limit their work to special groups will have an opportunity to do so, the regular course in zoology, in charge of Professor Bumpus, will embrace a study of the more typical marine forms and elementary methods of microscopical technique. Mr. W. A. Setchell will have charge of the work in botany. The tuition fee is thirty dollars, payable in advance. Applicants should state whether they can supply themselves with simple and compound microscopes. Microscope slides, dissecting and drawing instruments, bottles, and other supplies, to be finally taken from the Laboratory, are sold at cost. Further information, if desired, may be had by addressing Professor Hermon C. Bumpus, Wood's Holl, Mass.

Applications for places in either department should be addressed to Mrs. Anna Phillips Williams, secretary, 23 Marlborough Street, Boston.

Rooms accommodating two persons may be obtained near the Laboratory, at prices varying from $2 to $4 a week, and board from $4.50 to $6. By special arrangement, board will be supplied to members at The Homestead at $5 a week.

A Department of Laboratory Supply has been established in order to facilitate the work of teachers and others who desire to obtain materials for study or for classes. It is proposed to furnish, e.g., certain sponges, hydroids, starfishes, sea urchins, marine worms, crustaceans, mollusks, and vertebrates, preserved in good condition, at fair prices. Orders for the coming college year should be given as soon as possible. Circulars giving information, prices, etc., may be obtained by addressing the Department of Laboratory Supply, in care of the secretary.

Wood's Holl, owing to the richness of the marine life in the neighboring waters, offers exceptional advantages. It is situated on the north shore of Vineyard Sound, at the entrance of Buzzard's Bay, and may be reached by the Old Colony Railroad (2½ hours' from Boston), or by rail and boat from Providence, Fall River, or New Bedford. Persons going from Boston should buy round-trip tickets ($2.85).

The annual report of the trustees, containing an account of the organization and work of the Laboratory, may be obtained from the secretary.

HOMOPTERA INJURIOUS TO GRASSES.

AMONG the many insects that are destructive to the grasses the little leaf-hoppers take a very prominent place, and the writer is of the opinion that, although their work is often or for the most part entirely overlooked, they are really responsible for much of the damage accredited to other insects or to drought. Studies carried on during the last few years, and which have been reported in bulletins of the United States Department of Agriculture[1,2] and of the Iowa Experiment Station,[3,4] lead to the opinion that from one-fourth to one-half of the crop is lost regularly as a result of their work, and that a large part of this loss could be saved by the adoption of remedial measures. It seems also, at least for blue-grass in Iowa, that the common affection known as "silver-top" is to be charged against these same insidious enemies.[5]

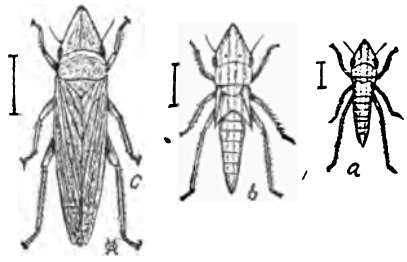

FIG. 1.

Diedrocephala mollipes (Original).

While there are many different species concerned in this work, many of which have still to be studied, and representing the families *Jassidæ*, *Cercopidæ*, and *Fulgoridæ*, the most numerous, and I think the most destructive, fall in the family *Jassidæ*, and a few of the more common ones may be enumerated here.

FIG. 2.

Deltocephalus inimicus (Original).

Diedrocephala mollipes is a grass-green species about one-third of an inch in length, and its general form, as well as the larva and pupa are shown in the accompanying figure. It occurs abundantly all over the country, but may be noticed more abundantly some seasons than others, and it shows a preference for ground that is moist rather than for very dry localities.

A quite similar species, *Diedrocephala noveboracensis*, is also quite abundant and widely distributed, but seems to occur more especially around the borders of thickets and in grassy woodland.

Perhaps the most abundant and widely distributed species of all is the *Deltocephalus inimicus* of Say. Its work ranges all through the season, and it may even be found on warm days in winter.

The insect is nearly a fourth of an inch in length and of a grayish color, the most distinctive marks being the black dots on head, front portion of thorax, and on the scutellum; two on each, as shown in the accompanying figure.

Another species which occurs, at times in immense numbers, is the *Deltocephalus debilis* of Uhler. This is smaller than the preceding species, but without a careful examination may be very easily confused with it. It is quite uniform in color, and without the black dots characteristic of that form. Its distribution is probably very wide, though it has not as yet been reported from as many localities as the preceding species.

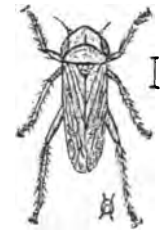

FIG. 3.

Deltocephalus debilis Uhl. (Original.)

Aside from these especially abundant species there are many others belonging to the genus *Deltocephalus*, which seem to be confined to grasses as their food plant. *D. sayi*, *D. harrisii*, *D. melsheimerii*, and others having been taken in greater or less abundance in sweepings from grass.

Cicadula exitiosa Uhler was first described as a wheat pest, but it has proven a general grass feeder, and must be enumerated among the species affecting this crop. It is about two-tenths of an inch in length, of a brownish color, and the wings are quite distinctly marked with dark veins.

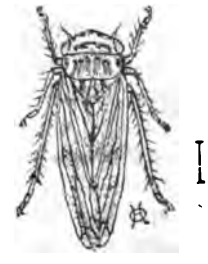

FIG. 4.

Cicadula exitiosa Uhl. (Original.)

The figure shows its form and the arrangement of the markings of the body.

Agallia sanguineolenta Prov. is an interesting little species, often secured in grass and conspicuous in very early spring, as the adults can be seen in great numbers under the grass or, on warm days, hopping about on the leaves. It has proved, however, to favor clover as its food plant, and probably feeds on grass only during fall, winter, and early spring. It is about one-eighth of an inch in length, quite broad, about half as wide as long, and marked with numer-

[1] Bulletin No. 22, Division of Entomology, United States Department of Agriculture, pp. 20-41.
[2] Bulletin No. 23, Division of Entomology, United States Department of Agriculture, pp. 58-59.
[3] Bulletin No. 13, Iowa Experiment Station, pp. 95-101.
[4] Bulletin No. 15, Iowa Experiment Station, pp. 258-261.
[5] Proceedings of the Society for Promotion of Agricultural Science (1890).

ous dark blotches and short stripes, especially on the wings. This species appears to be double-brooded in the latitude of Iowa, though it is possible that three broods may occur.

The habit these insects have of hopping into the air on the least disturbance renders them open to direct attack with the "hopper-dozer" principle, which has been used so extensively in the contests with the Rocky Mountain Locust.

We have found, however, that a very simple plan of using this principle is the most effective in securing the leaf-hoppers. It consists in coating the upper surface of a sheet of sheet-iron with coal tar, attaching cords at either end, and also in the centre if it is very long, with which to draw it,

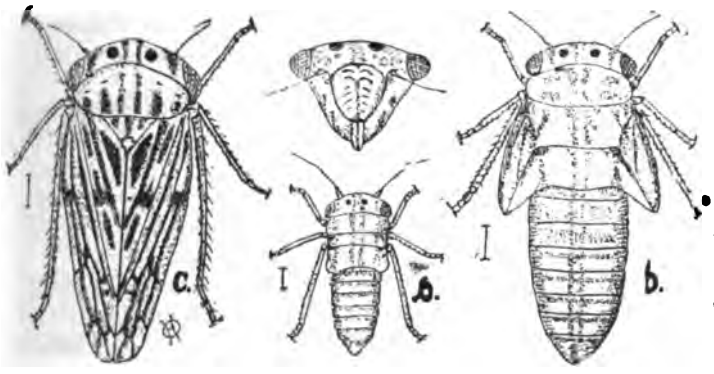

FIG. 5.

Agallia sanguinolenta: A. larva; *B.* pupa; *C.* imago, and front view of head of imago. (Original). Size lines are a little too long.

and then it is drawn over the lawn or pasture at a moderate walk by a boy or man at each end.

As soon as the sheet becomes covered with hoppers so that all are not held when they strike the pan a new coat of tar is applied. On an extensive scale this can be used at a cost of but a few cents per acre, and is applicable to large pastures and meadows. Upon lawns and pastures the treatment may be applied at any time when the hoppers appear numerous, but in meadows it is not applicable while the grass is in bloom on account of the accumulation of pollen on the sheet. In general, the best time to apply it is in early May and again, if hoppers are present, in summer, directly after the hay-crop has been secured. HERBERT OSBORN.

Ames, Iowa.

ASTRONOMICAL NOTES.

THE following is an ephemeris for the comet discovered by Denning on March 18. The epoch is for Berlin Midnight: —

	R.A. h.	m.	s.	Dec. °	′
April 25	2	18	44	+ 58	5.8
26		23	16	57	53.7
27		27	43	57	41.4
28		32	5	57	28.8
29		36	23	57	15.9
30		40	36	57	2.8
May 1		44	45	56	49.5
2		48	49	56	36.0
3		52	49	56	22.2
4	2	56	45	56	8.3
5	3	0	37	55	54.2
6	3	4	24	55	54.2
7	3	8	8	+ 55	25.6

This comet is now increasing its distance from the earth, but in the autumn the comet will again approach the earth, and observations will be possible far into next December.

The following is an ephemeris for the comet discovered on March 6 by Dr. Swift of Rochester, N.Y. The epoch is for Berlin midnight: —

	R.A. h.	m.	s.	Dec. °	′
April 25	22	14	21	+ 16	10.0
26		17	30	16	57.9
27		20	37	17	45.0
28		23	42	18	31.2
29		26	46	19	16.6
30		29	48	20	1.2
May 1	22	32	49	20	44.9
2		35	48	21	27.8
3		38	46	22	9.8
4		41	42	22	51.0
5		44	36	23	31.4
6		41	29	24	11.1
7	22	50	20	+ 24	50.0

These ephemerides are taken from No. 3,082 of the *Astronomische Nachrichten*. That for comet Swift was computed by Dr. Lamp, and that for comet Denning by Dr. Schorr.

The new star in Aurigæ has now become so faint that it can be observed only in the larger telescopes. It is fainter than the 13th magnitude. G. A. H.

NOTES AND NEWS.

MR. G. C. GREEN records in *Nature Notes* for April a curious reminiscence with regard to a pair of jackdaws kept by him at Modbury Vicarage, South Devon, about twenty years ago. They had been taken from the nest, and during the first summer their wings were slightly clipped. After this their wings were allowed to grow, and they lived at full liberty in the garden. They were perfectly tame, and would come at call and feed out of the hand, would come into the house, and in the morning knock at the windows to ask for some breakfast. In the spring they used to fly away and join their wild companions, make their nests, and rear a family; but when this was over they came back to the garden again, fed from the hand, and were as tame as ever. But the curious thing was, that after one or two seasons they brought another jackdaw with them, presumably the young of one of them, which was just as tame as themselves, although nothing had ever been done to tame it, so that it was impossible to tell which were the original favorites, and which was the new one. Moreover, when after a few years one of these jackdaws was accidentally killed, another was brought by the other two.

— A Seaside Laboratory of Natural History, in connection with the Leland Stanford, Jun., University, will be opened during the coming summer at Pacific Grove, Cal., on the Bay of Monterey, about half-way between Monterey and the Point of Pines. This laboratory will be for the purposes of investigation in the life-history of the marine animals and plants of this coast. It will be under the direction of Professors Gilbert, Jenkins, and Campbell of the chairs of zoology, physiology, and botany respectively. It will be open to naturalists and others wishing to make special investigations in the anatomy or life-history of animals and to teachers of natural science. For further details those interested may apply to any of the directors at Palo Alto, Cal.

— In a discussion on diphtheria, published in the *British Medical Journal* for Sept. 19, 1891, Dr. Russell cited several instances in which steam had seemed to be an active factor in the propagation of the disease. Hot water and steam from a brewery were introduced into some old cesspools and evidently waked into activity germs which, if undisturbed, would have remained dormant.

— A new edition of S. Dana Horton's "Silver in Europe" will be published immediately by the Macmillans. The author has made some additions of importance to this edition in view of the present attitude of Congress on the question of free silver.

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Attention is called to the "Wants" column. It is invaluable to those who use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

For Advertising Rates apply to Henry F. Taylor, 47 Lafayette Place, New York.

CURRENT NOTES ON ANTHROPOLOGY. — IV.

[*Edited by D. G. Brinton, M.D., LL.D.*]

The Study of Jargons.

Only lately have linguists awakened to the extreme value of the study of jargons, and of hybrid and mixed languages. The fact is that in such we have the nascent condition of speech, the parturition of language, caught in the act. The phonetic and grammatic laws we see at work in the formation of a jargon are the same which have given to all existing tongues their form and idealogy.

The linguist to whom we owe the most in this new field is Hugo Schuchardt of Gratz. His works, published by the Imperial Society of Vienna, have presented especially the mixed dialects arising from the intermingling of Spanish and Portuguese with the native tongues of Insulindia. His analyses of them are masterful, and may justly serve as models for all similar researches.

More interesting to American readers is the recent publication of Dr. Karl Lentzner of Berlin, "Wörterbuch der englischen Volkssprache Australiens." It is in English in spite of this German title, and presents glossaries of Australian, Anglo-Indian, Pidgin English, West Indian and South African words. He adds an appendix, with numerous examples, and a discussion of these curious forms.

The book offers racy material for a magazine article, is full of quaint and humorous expressions, and tempts to numerous extracts. But it is enough to name it here, that it may not be overlooked by those who are interested in "Americanisms," folk-lore, slang, and such developments of language.

The Lotos-Eaters and the Troglodytes.

There is something peculiarly attractive in following the ancient Homeric voyages by the light of modern science. Who were the "mild-eyed, melancholy Lotus-Eaters," who dreamily strolled their island shores? Who the Troglodytes, cave-dwellers, speaking a strange language, which Herodotus compares to the squeaking of rats?

Two recent articles enables us to answer these questions satisfactorily. The one is by Dr. E. T. Hamy, in *L'Anthropologie;* the other by Rudolf Fitzner in the *Globus* (Band lxi.). The Lotos Isle was undoubtedly the island of Djerba, at the southern entrance to the Gulf of Gabes (north latitude 33° 40′). Its population is of unusually pure blood, and presents a fine example of the native blonde type of Northern Africa. The complexion is a full white, or slightly reddish, the head short, the face round, the nose straight, the lips thin. In other words, they are entirely similar to the Kabyles of the Djudjura, and the Rifians of Morocco. All three belong to the true Berbers, and speak near dialects of the same tongue.

The Troglodytes are of the same blood. They also are Berbers, of the stem of the Matmâta, living in the mountainous region between the Gulf of Gabes and the great salt lagoon, the Schott El Djerid. There they construct their strange, boat-shaped, cave-dwellings, just as they did in the days of Sallust and Herodotus and long before.

It is interesting to note that Fitzner (who adds a good ethnographic map of the regency of Tunis) recognizes the probable ethnic identity of the Berbers, Iberians and Etruscans,—a relationship which I believe I was the first to maintain.

A Native Maya Historian.

One of the most interesting documents relating to the history of America in the sixteenth century is a narrative of the Spanish conquest of Yucatan, written in his native language by a chieftain of one of the subjugated Maya tribes. The original text was published complete for the first time in Vol. I. of the "Library of Aboriginal American Literature" (Philadelphia, 1881), with an English translation. It merited, however, a much more complete analysis than was there given it, and this it has lately received from the competent hand of the eminent linguist, the Count H. de Charencey. Under the title, "Chrestomathie Maya d'aprés la Chronique de Chac-Xulub-Chen," he gives us an octavo volume of 301 pages containing the original Maya text with an interlinear translation in Latin, an exhaustive grammatical analysis, and a complete Maya-French vocabulary.

M. de Charencey very justly remarks that there is scarcely any other American language which presents so much interest as the Maya, in view of the high civilization of the people who spoke it, as well as its own linguistic traits. His excellent "Chrestomathie," therefore, should be obtained by all our leading libraries. It is published in Paris, Librairie C. Klincksieck, 11 Rue de Lille.

Dr. Topinard's Latest Work.

All who know anything about the literature of anthropology are acquainted with the works of Dr. Paul Topinard, and will acknowledge that there are none better on physical anthropology. The latest from his pen is "L'Homme dans la Nature" (Paris, 1891), a title which cannot be considered a very fortunate one, as it is difficult to imagine where else man could be than in nature. But let that pass. The interest of the volume lies in the more pronounced position which the author takes on the theory of human evolution, or, as the French prefer to call it, transformation. This theory is undoubtedly less popular in France than it was

ten years ago, a change mainly owing to direct and indirect clerical influence; and it is therefore gratifying to find an eminent teacher like Topinard, boldly pronouncing in its favor, and declaring that it is the only possible theory adequate to explain known facts in the physical history of the human species.

The author makes frequent reference to his larger work "Eléments d'Anthropologie Général"; but the instructions for practical observations and the abstracts of the results of other investigators furnished in the present much smaller volume, will be sufficient to satisfy those students of the subject who feel themselves somewhat appalled by the nearly twelve hundred closely printed pages of the "Eléments."

Some Native Brazilian Tribes.

A model ethnographic study is that of some Brazilian tribes by Dr. Paul Ehrenreich, published in the second volume of the *Veröffentlichung aus dem Königlichen Museum für Völkerkunde zu Berlin*. He takes up the Karaya stock on the river Araguaya, and some tribes, the Paumari, the Yamamadi and the Ipurina on the Purus River. His descriptions meet all our requirements except in the important matter of language. This he no doubt designedly omits; though he mentions that among the Karaya the men and women have separate dialects, rarely, however, radically different words.

Of these little-known peoples he describes the costume, house-building, methods of obtaining food, tools, and weapons, etc. It is curious to note the love of the Karayas for taming animals. "Their villages resemble menageries." Dogs, fowls, cats, peccaries, parrots, even turtles, alligators and tapirs, meet the astonished traveller. The native does not look upon them as "lower animals," but quite on the same plane of existence as himself, and as his friends and companions.

The history and extension of the tribes are defined, and a number of admirable photogravures set forth truthfully to the eye their physical characteristics.

A MACHINE FOR CHURNING FRESH MILK.

In Bulletin No. IX. of the Delaware experiment station (Newark, Del.,) are given the results of a series of experiments made to determine the practical value of the butter extractor, a machine with which butter may be made directly from the freshly drawn milk.

In principle this machine resembles the DeLaval separator, which has now come into general use in creameries and large dairies, by which the cream is separated from sweet milk by centrifugal motion, but the butter extractor goes a step farther, and not only separates but churns the cream.

The machine operated with was made by an American company. It was found to require considerable experience to operate it successfully, and the tests upon which the station's comparisons are based were made under the personal supervision of the manufacturers of the machine. The results were that it was found that while the separator and churn obtained 93.34 pounds of butter out of every 100 pounds in the milk, the extractor obtained but 84.60 pounds, a loss of 8.74 pounds, and the butter thus obtained was of such quality that it could not be sold in competition with butter made from ripened cream.

In summing up the results of his tests Professor Penny, the chemist of the station says: —

"As to the relative expense of running in the one case the extractor alone and in the other the separator and churn together, it is doubtful if a creamery having only one machine would save anything in the number of hands employed, while in larger establishments the loss, greater by 8.74 per cent, caused by the extractor is heavier than the saving in wages. On a daily business of five thousand pounds of milk this deficiency is equal to fifteen or seventeen pounds of butter, yet such a business with the separator and churn need not employ more than two men, and the extractor could hardly employ fewer. The expense for power, etc., is nearly the same in the two cases. It must also be considered that while the separator requires the milk to be previously heated during much of the year—a simple and cheap operation—the extractor requires it to be cooled, at least in warm weather, and this calls for a greater supply of cool water or of ice—a decided disadvantage and in some creameries an unwarranted expense.

"Hence one feels justified in concluding that, if the quality of the butter be left out of the account, the extractor at present offers no substantial advantage that is not outweighed by defects, and that it would not allow any saving in expense over the process it is designed to supplant.

"Run as a separator alone under good conditions, this machine ought to give most excellent results, though in common with the DeLaval, and doubtless others, it varies greatly in skimming power, from causes that are partly unknown. As a skimmer it may be considered strictly first-class.

"Although the extractor appears unfavorably in comparison with a much older method, it cannot but be regarded as a marvel of inventive and mechanical skill. The surprise is in the first instance that it should do its work at all, and then, even though it be found wanting, that it should do its work so well. It is brought at the start into competition with a highly perfected machine and a method thoroughly understood from many years of experience. Its shortcoming under the severe test to which it is obliged to submit ought not to be cause of disappointment; there is room rather for encouragement, because it has done so much. Its future development is probably a question of the relative merits of sweet-cream butter and sour-cream butter.

"If experience and an educated taste shall finally favor the former, the extractor may be expected to take the place of the separator and the churn. But unless the decision shall fall in that direction, it is doubtful if the new device ever comes into general use."

It should be added to the foregoing that the comparison was made with the most perfect method of separating cream from milk now known. Had the extractor been compared with the old method of raising cream, the outcome would have been less unfavorable, as the separator gets out more cream than can be raised by gravity.

THE HIGHER EDUCATION OF THE DEAF.[1]

NATIONAL DEAF-MUTE COLLEGE,
WASHINGTON, D.C., April 1, 1892.

A. L. E. CROUTER, A.M., Principal:

My Dear Sir.— Your suggestions have received my most serious consideration. Allow me to thank you for the assurances of your friendly regard for the college and your appreciation of the value of the work it has already done. More grateful to the officers of the college than any written words could be, is the record of your

[1] Reply of President Gallaudet to the letter by Principal Crouter published in Science for April 8. Reprinted from the Silent World.

past efficient support of its work by the sending of a large company of students to it well prepared to enter and to profit by its advantages.

The proposal that the college should provide oral recitations for students that have been able to engage in such recitations in the schools in which their preparation for college has been completed, appears at first glance to be a very natural and proper one. A full study of the subject, however, discloses objections which to many minds will seem very serious. First of all should be considered the expense of carrying your suggestion into effect, not for a single year only, which would be small, but for the five years of the college course, which is quite another matter. The time and strength of the professors now at the command of the college are fully consumed with the duties at present assigned to them, and were separate oral recitations provided for orally taught members of each class, a complete duplication of the faculty would be demanded, and this not only as to numbers, but also as to ability, qualification, and experience. Such an increase of our teaching corps would involve an additional annual expense of at least ten thousand dollars.

The whole force of your suggestion rests, if I mistake not, on the statement that the pupils of oral schools "hesitate, and object, and refuse, when directed to Kendall Green, not because it is not a good school, nor because its professors are not competent men, but because of a well founded fear that that which they have spent much time and labor in gaining, namely, their speech and their ability to read speech, may be very seriously impaired" by the lack of oral recitations in the college. Now I will lay no stress, as many would, on the admission made in stating this point, that the speech and power to read the lips of others, gained only at great cost by the orally taught deaf, are possessions which may easily be lost; for my experience leads me to have much more faith in the security and permanence of these valuable acquisitions than you and Mr. Greenberger seem to enjoy, and my reasons for this stronger faith will presently appear.

It is not true, as the uninformed reader would infer from your letter, that the orally taught deaf of the country have never enjoyed the advantages of the college. Pupils from the Clarke Institution, from the Boston Day School, from private oral schools, from Mr. Greenberger's school, and last, but not least, a pupil who had for several years the special training of Professor Alexander Graham Bell, have been connected with our college for longer or shorter periods, one of them graduating with honor from our scientific course. None of these students enjoyed the advantages of oral recitations in the college. They had no special teaching in speech or lip-reading. They did, however, have considerable practice in speech while connected with the college.

No complaints came to me from these pupils, nor from any of their friends, while they were with us or after they had left us, that their powers of speech and lip-reading were even temporarily, much less permanently, impaired by their connection with the college. The father of one of Mr. Greenberger's pupils, who was for two years a student here, writes, under date of March 29, 1892: "In reply to your inquiry I desire to say that H. did not speak quite as well on his return, perhaps because that at college he had not as much chance to use his lips as he did while at school in New York, but since he is home, our conversation at home, as well as in our business with him, is so frequent, that I am happy to say he speaks as well and as understandingly as ever."

The father of another of Mr. Greenberger's pupils who pursued our full scientific course, taking the bachelor's degree, says in a letter just received: "I do not think my son's power of speech and ability to read the lips were injured in the least by his taking a course in your institution."

Four others of the orally taught pupils to whom I have just referred have informed me within a few days that, on the testimony of their friends, they experienced no permanent injury to their powers of speech and of lip-reading in consequence of their connection with the college. And the friends of two of these thought their speech improved while they were in college.

Now, in considering the cases of these orally-taught pupils to whom reference has been made, it must be kept in mind that they were all connected with the college at periods when no instruction in speech and lip-reading was afforded to any student. And yet it appears that not one of these young people, representing as they did the leading oral schools of the country, suffered any permanent injury to their powers of speech and lip-reading while students here. What more convincing proof could be given that the "fears" of the oralists voiced in your letter are not "well-founded?" And if these fears are justly dissipated by the records of times when no articulation teaching was afforded in the college they surely need be accorded little weight at present, when ten instructors are actively engaged in giving daily lessons in speech and lig-reading to the students of the college. There are those whose opinions are entitled to respect, who believe that the plan put in operation the present year by the college for preserving and improving the speech of all its students, including the orally taught, will produce more satisfactory results than the one proposed by you, which would involve, inevitably, an increase of ten thousand dollars in the annual expenses of the college, and this for the sake of a number of students not likely to be more than twenty-five. And should the alternative you press in your letter as, apparently, an ultimatum, be followed, of establishing a college especially for the orally-taught deaf, the increase in the expense of their higher education would be much greater than even the figure I have named. We are trying an experiment, the results of which are thus far encouraging, to continue which will involve no increase of expense, while you urge a scheme certain to be very costly, and by no means sure to give better results. In view of the unprecedented facilities for oral teaching newly offered in the college the present year, and which will be continued next year, will it not be safe to intrust orally-taught pupils to us for a year or two, or at least until it can be demonstrated that our way of preserving and improving their speech is a failure? For if it prove a failure, no one will be readier than I to accept such a result, and to advocate what you believe to be "the more excellent way."

The officers of the college are gratified at the prospect of receiving a greater number of students from the oral schools than have come to Kendall Green in the past, and while they cannot feel justified in acceeding to the particular demand of your letter, at least until their own experiment has proved a failure, they are ready to give the most earnest assurance that, with every orally-taught pupil who may seek admission here the coming year, no pains will be spared to preserve undiminished whatever powers of speech and speech-reading such pupils may bring with them.

The force at present available for articulation teaching in the college will make it possible for us to give special individual training to such orally-taught pupils as may seem likely to derive more benefit from instruction so afforded, than when given in a class.

Some editorial comments on your letter, which appear in the *Silent World* of yesterday, leave me to say, in closing, that nothing could be further from the truth than an assertion that the present attitude and existing arrangements of the college as to oral teaching put the stigma of governmental condemnation upon the oral method. The fact that ten instructors are devoted to the work of speech teaching in the college is a sufficient refutation of any such claim. It by no means follows because a certain manner of using a certain method is found helpful to certain deaf children in primary schools, that the identical way of making use of this method is necessary, or will even lead to the best results, with these same persons under the changed conditions of collegiate instruction. And it would be a most distorted inference to conclude that because the college gives oral teaching to its students in a manner somewhat different from that employed in the pure oral schools it is thereby placing a stigma on the oral method.

The editor of the *Silent World* is quite right in acquitting "the authorities at Washington" of any such intention, and I trust the statements of this letter will give wings to all his apprehensions on the subject.

Our directors feel that the existing arrangements of the college, under which the essential features of the two leading methods of instruction are combined in a manner calculated, as they believe, to produce the best results, ought to satisfy the friends of both methods.

They have great confidence that results in the near future will

prove the wisdom of these plans. And whether this confidence be misplaced or not, they think they have a right to expect that no unfriendly attitude will be taken towards the college while the important experiments only recently begun are being pressed steadily to a decisive conclusion.

Very sincerely yours,

E. M. GALLAUDET.

THE TEACHING OF SCIENCE.[1]

THE subject chosen for this paper, The Teaching of Science, is a broad one; far too broad for more than a very superficial treatment in the time allowed, but it is my purpose rather to call attention to certain general ideas in which too much of our modern science teaching seems to be at fault, and to try to suggest lines in which we may hope for improvement, While I use the term "Science," I have particular reference to the so-called natural sciences, though perhaps the ideas are capable of a wider application.

Among these natural sciences there are certain ones to which my attention has been more closely drawn, but I believe the principles which should be at the basis of instruction in them will apply equally well to all.

Why do we study the sciences? how far do we attain our ends in this study? and is it possible for us to attain them more completely than by our present methods? These are the three questions I desire to consider.

1. Why do we study the sciences? Were we to judge from the great mass of science teaching of the present day, we would be obliged to answer unhesitatingly that the natural sciences are taught chiefly at least, for the purpose of acquiring certain facts which are supposed to be of the necessary stock in trade of a well educated man or woman, or perhaps I should speak more correctly, were I to say, facts which every well educated person ought once to have known sufficiently well to have passed an examination in them; in as much as, for better, for worse, most have forgotten a great share of these acquired facts. I say were we to judge by the way science is taught, though few teachers would admit this mere acquisition of facts to be their aim in teaching. If we should inquire of these teachers, they would undoubtedly tell us of the "disciplinary value," that vague expression often heard and so unsatisfactory to the pupil, as he repeats his *amo, amas, amat*, or pauses to rest on his *pons asinorum*.

In all education we have two aims; the direct furnishing of the mind with a store of facts and the development of the mind so that it can utilize these facts and attain others; we teach, and we teach how to learn, Now there are undoubtedly, a vast multitude of facts in the natural sciences, which are of practical value in every-day life; but after all these are of little importance compared with the tremendous development of the mind which may be and ought to be gained by this class of studies.

The natural sciences are pre-eminently the studies to develope the reasoning powers; every step has been and can be logically worked out from the preceding; nowhere else do we find that gathering of facts, perhaps very few in number, under an hypothesis, and then, by gaining new facts by study and experimentation, the development of the hypothesis into a theory and, it may be, a law. The best instruction in logic I ever had was in a class of a dozen or so, where we had each made quite a series of apparently unconnected experiments in physics, then were given the task of arranging our descriptions of these experiments in their proper sequence, discussing in the class room our arrangements and defending each his own choice.

The chief aim in the study of science should be this development of the reasoning power; the teaching of independent thought; and the acquisition of facts in themselves, however important some of them may be, should invariably be made subordinate to this. I ought in this connection to refer to what is often spoken of as a very important aim of science teaching, that of training the power of observation. Of course when rightly studied, science does train this power, and even the most superficial elementary course in any science cannot fail to make the scholar now and then a little more interested in observing what goes on around him than he otherwise would be; nevertheless the training of this power is of value only just as far as it is a means of training the reasoning power. A man may have a marvellous gift of seeing everything and seeing it accurately; but this gift is of value to him only as far as he can utilize it as a basis of thought; and therefore I would hold that the training of the power of observation is embraced under the all important aim of science teaching, the development of the mind, the development of the power of thought.

This should be the chief aim of all instruction in natural science; all else is of little use.

2. Now how far does the instruction given in our institutions of learning, our schools, academies, colleges, and universities, tend to carry out this idea?

Until until quite a recent time there has been little or no instruction in natural science given in our lower schools; in our cities at the present time there is more or less of an attempt being made to introduce the study of chemistry and physics. I leave out of account for the present the kindergarten, where there seems to have sprung up a germ of the true idea of science teaching. The most that is expected in our common schools is that the teacher shall hold a few recitations from a text-book, from which the scholar is supposed to familiarize himself with a large or small number of facts and possibly to learn the statement of a few laws or theories. In the higher schools, the academies, and some of the colleges, a somewhat greater task is attempted; here the text-book is supposed to cover practically the whole science and a correspondingly great number of facts is sought to be memorized; with a couple of recitations a week, the student is expected to go through "fourteen weeks in chemistry," or physics, or geology, and to have learned the gist of the whole science. Here we have a mere feat of memory, of just as much value, perhaps, as the committing to memory of so many lines of "Paradise Lost," certainly no more. In many, perhaps most, cases the teacher is as ignorant of the subject as the scholar, and must have the text-book continually open in order to recognize if the answers are correct. One college in Kentucky advertises to give complete, thorough, and practical courses in each of the sciences in a term of ten weeks; think of acquiring chemistry, physics, geology and astronomy in less than a year, and not neglecting other studies in the meantime! Of late, however, it is coming to be very generally recognized that scientific instruction cannot be imparted without experiment, and so the teacher performs before the class some of the simpler experiments. This is indeed a step in the right direction, but in most cases only a very short step. An experiment merely as something for a class to look at or be entertained by is valueless; indeed the only value of an experiment is in making clearer the principle it is intended to illustrate. If it fails to do this, it fails to accomplish any thing. I remember asking a young lady, who had a few months previously passed a fine examination in chemistry in one of our higher institutions, if she remembered how oxygen was made, "Oh yes," she said, "why! the professor took something black and something white, and that was oxygen." Some features at least of the experiment had made an impression. In most of the colleges and academies for ladies, I think it is no exaggeration to say that science study as usually conducted is of no value; the only science which there is an attempt to study at all thoroughly is botany; and even here it is questionable to my mind if the student get from this any thing which justifies the time put upon it, except that incidentally the fresh air exercise obtained in gathering specimens provides that which is much needed by all young ladies. The end usually sought is ability to analyse, by the aid of tables, the common plants, rather than the study of these plants. In no other science is the absurdity of this method of study so apparent. In the chemical laboratory it is true that the use of analytical tables is a prominent feature, but there seems to be at least a practical end attained. Imagine a study of zoology or of mineralogy which should find its end, not in studying the animal or the mineral, but in merely finding out by a set of artificial tables what it is, and we see the fallacy in calling it science. I believe it would be better for all students of botany, and I think

[1] Read before the Kentucky College Association at its latest meeting.

I may add, of chemistry as well, were all analytical tables destroyed.

This brings us to the subject of laboratory work, the *sine qua non* of scientific study. This is at the present day, so far acknowledged that in none of our colleges, and few of our better high schools and academies, would the instructors think for an instant of trying to teach certain sciences without the laboratory. We may thank the chemist for the introduction of the laboratory idea. But to-day there are few colleges, except the larger, and still fewer of our academies, where we find physical or biological laboratories; yet, even with the laboratory, we have by no means reached the ideal in scientific instruction, save in a few institutions. Take, for example, much of the laboratory instruction in chemistry. With a book of directions before him, the student performs certain experiments; with a set of tables, he goes through the process of perhaps separating the metals, and may become even a good analyst, without having profitted to any considerable extent by his work, all being performed mechanically. In the physical and biological laboratories there is far less danger of this misapplication of scientific study, and this largely from the fact that laboratory work in these sciences is a more recent idea and less systematized. In our modern education there is a most pernicious tendency, well exemplified in botany and chemistry, as we have seen, but found in other studies than the sciences, toward machine instruction. Everything is most systematically arranged, and students, bright and dull, are all dosed with so much per diem. The text-book is made everything, and the teacher nothing; and, as a result, we are losing our teachers. Their function seems to be no longer to teach, but merely to see that the required dose is taken. The scholar loses his individuality, and merely becomes like the Strassburg goose, cooped up and so much food forced down its throat so many times a day, the only demand being that on examination day its liver shall have attained the regulation size. In our larger colleges, where each instructor is confined to but one branch, and is, as a rule, an expert in teaching that branch, things are more as they should be; the true aim of science study is more nearly attained. But here these instructors are met with the difficulty that the student has so long been the victim of bad methods that it is almost impossible to successfully introduce the good ones. Then we must further even bear in mind that the great mass of the youth of our land do not have the advantage of college. It is but a small percentage who even enter the high school. Has science nothing to do for those whose school-years are few in number and who are to make the great bulk of our citizens? I believe she has, and will try to point out, or at least to hint at, what seem to me to be the methods by which science-teaching can be made to accomplish its true mission.

3. That which we must seek to do may be expressed very simply. We must seek to so teach science that the student, be he man or woman, boy or girl, or even a little child, shall be led to think about phenomena. If the great good to be attained by science study is the development of the power of thought, we must do all in our power to induce thought. The kindergarten, child's play, as too many consider it, may teach us an important lesson. It is play indeed, but the child is led to think about his play, and the effect of kindergarten instruction may be clearly seen in those who have had the advantage of its training. It is surprising how few even of our college students are capable of independent thought. We see the lack of this thought in the sets of answers to examination questions now and then published, generally with the idea there is something humorous about them. They may for the moment excite our laughter, but rather are they a cause for pain, as bitter examples of the deficiency of our system of education. I would have science-teaching begin with the first of a child's education, or rather it should begin at home, long before the child is thought old enough to study the alphabet. If the child is taught to notice anything in nature, be it a stone or an insect or a little rill of water, he will need but little encouragement to ask questions about it, and, by a judicious directing, he can be led to do his own answering. I have seen a little girl, hardly six years old and unable to read, reason out for herself the general principles at the basis of evolution by merely calling her attention to a few little clumps of blue and white and yellow violets, growing in close proximity. In the lowest grades of our schools the teacher should encourage children to collect all kinds of natural objects, and those found in any locality will be amply sufficient for science study. One of the "plays" in the kindergarten is for the children to plant different kinds of seeds and watch their growth. Similarities and dissimilarities attract attention. We all know the innate desire in every child to dig up the recently-planted seed and see how it grows. The kindergartner wisely utilizes this.

In the few years of common school, the child will have perhaps not the least systematic scientific knowledge, but he will have learned to think about all that goes on around him, and then when, at a later period, he takes up the sciences systematically, he will find that he is already possessed of a great number of facts which will almost arrange themselves, and that not merely in an orderly manner but, what is far more important, intelligently. In our common schools I would have science instruction given from the lowest to the highest grade, and this wholly without the aid of text-books. A short time should be taken every day, with each class, for this purpose, the teacher endeavoring to interest the class and draw them out on some natural object or phenomenon.

It matters little what the particular science chosen may be; if there be one in which the teacher is especially interested, that is the one to use; a handful of marbles, a base ball, or a bat, will serve to interest the boys and instruct them on many a point in mechanics; a few rubber bands stretched across a cigar-box, in sound; a mirror, a burning-glass, and a prism, in light; zoology affords, throughout its whole field, countless specimens for entertaining instruction to the young; they may in familiar examples, and in specimens of their own collection, study the different developments and uses of homologous organs, as the arm of man, leg of mammal, wing of bird, and fin of fish; or the different modifications of the same organ, as the comparison of the eyes of vertebrates with those of insects and molluscs; or the different organs used for the same purpose, as the organs of prehension in man, monkey, elephant, parrot, snake, lobster, and insect; or, on the other hand, they may find it more interesting to study from a systematic standpoint, finding out for themselves the differences between animals of different classes, as between herbivores and carnivores, insect-eaters and rodents, insects and spiders, one-shelled and two-shelled molluscs. It may in some localities be possible to compare some of these modern forms, as snails, with very similar fossil specimens near at hand; and here we can call geology and paleontology to our aid in work with children. And again, just to allude to one more science available for this work, the kitchen closet, with the occasional aid of a few cents' worth of some acid or the like at the drug store, will afford us most ample opportunity of impressing the most important lessons of chemistry; combustion, respiration and decay, pure air and ventilation, dryness as a disinfectant, fusion, solution and crystallization, and a thousand similars, many of them of great practical value in their applications, but far more useful as agencies for thought development, come to our mind as possibilities in chemistry as a science for the young. I might take up each science in its turn, for each can easily be made to serve its purpose, but these examples will illustrate what can be done in any one of them; not one thing mentioned but is within the reach of any faithful common school teacher; but how long will it be before we see any general materialization of such ideas?

Thus far I have referred to scientific instruction in the lower schools, which do not so directly concern the members of this association; the same principle, however, is applicable to the higher schools, and we must not forget that the lower schools, which lie at the basis of our civilization, are just what our higher institutions make their teachers. When the high school and academy are reached the possibilities in scientific instruction broaden vastly. In the case of those who have had such elementary training as described, the task is easy; but the problem is harder with others, owing to the difficulty in teaching correct methods of study to those who have for a period of years been drilled in bad ones. Eight or ten years of learning by rote are enough to unfit a child

for anything else. Two points we must have before us if the scientific work is to be done for the purpose of attaining its chief end: we must as far as possible lose sight of study for either practical ends, or for the purpose of general information; and we must as far as possible adopt laboratory instruction. In regard to the first point, we suffer more in our academies and high schools, but perhaps also in our smaller colleges to a lesser extent, from rushing through these abbreviated courses in the sciences, than anywhere else; here it is chiefly that we find the task set of giving every student an outline view of every science, embracing as many diverse facts as his memory can hold. Particularly are the fairer sex compelled to suffer in this regard. Better far to take a single science and develop it much in the same way, though more systematically and to a more extended degree, as that already suggested for use in lower schools.

As regards the laboratory work, it may be very simple and inexpensive, but it is an invaluable aid in science teaching; a table, a dissecting case, a lens, a few glass jars, a few chemicals, and if possible a small microscope, slides and cover glasses, will form a sufficient equipment for a very practical biological laboratory; even some of these are not absolutely necessary, as the dissecting case may be replaced by a good knife. For botany the lens, or better the microscope, is almost alone needed; for mechanics, a few of the most familiar carpenters' tools and a bench for work, comprise the necessaries, while in the other branches of physics but little is needed. Even in electricity, a few pieces of copper and zinc, some old electric light carbons, a few chemicals, some wire and a magnet, will go a long way in instruction. Chemistry is supposed to require the largest outfit, and yet I think that some of our dealers in such goods could make no little profit by fitting up collections of chemicals and apparatus for the purposes we are considering, at the cost of not over a dollar for a full set for each student, and five times that amount for the teacher's set; in other words, expensive equipment is wholly unnecessary for elementary laboratory instruction in any of the sciences, indeed in too many cases, an extensive set of apparatus and fittings distracts the attention of the student from the experiment he is studying. Now in using the laboratory, let it be clearly understood that there is no "practical" aim sought, but merely that the student shall think out for himself all the facts connected with the experiment; if it be considered that a knowledge of certain facts is necessary to his education, let him be shown where in the dictionary or encyclopedia these facts may be found.

Our brains are limited in their capacity, and if we load them with that which is of little or no use, there will be little space left for that which is of more importance. Let the student know just where to go for these facts, rather than have his mind filled with them in preparation for examination day. Our aims in science study will be best attained by a few simple experiments, carefully studied and reasoned upon, and these every higher institution ought to furnish.

When we come to science instruction in college, the same train of reasoning applies, but here it is far easier to carry out our principles. It obtains in college, as in the lower institutions, that the student is expected to gain at least a smattering of the chief sciences; still, with our optional studies, the chance for obtaining the true aim of science study is far greater. One reason for this is the increased time allowed to each subject, and the fact that the teacher is more or less of a specialist in the branch or branches he teaches. Let us in this connection look a little more closely at the science with which I, as a teacher, am more familiar than any other, that of chemistry; for this will serve us as a type of them all. Chemistry is studied at college by two classes, one that desires to gain a thorough knowledge of the subject, usually for some practical end, and the other, generally comprising all the students who pass through college, desiring merely to gain a general view of the whole field. Since a thorough study of the chemistry of the non-metals is necessary as a foundation for further prosecution of the science, and since the time required to lay such a foundation is fully as much as the majority of the students can spend on the whole subject, it has been in many places in time past, and indeed perhaps we may say is to-day, the general plan to let the two divisions work in entirely different plans, the one class going superficially over the whole subject of chemistry in a term, while the other proceeds slowly and thoroughly. This is, I believe, a great mistake; the rapidly moving class is at just the same disadvantage as the academy and high school classes we have already noticed; they are trying to learn facts and statements, and thereby lose the true aim of science study. It would be far better for them by slow study to thoroughly master the principles of the science, and gain its value in stimulating thought, and in a few days' reading at a later period they could gain a far better knowledge of the whole subject than otherwise in the whole term. The student should, in the laboratory, perform after the professor each of the simpler experiments, and be questioned particularly and chiefly as to the meaning and signification of the experiment. In the quantitative laboratory he should study the metals comparatively, paying particular attention to similar reactions by which metals may be classed together, and to dissimilar reactions by which the metals may be distinguished and separated. In this way he may cut himself loose from all artificial tables except as far as he shall form these tables for himself as a result of his work (I may here perhaps be allowed, by way of parenthesis, to add that I believe it will be found more advantageous for the student, when beginning work on the metals, to examine first the effect of each of the common reagents upon all the metals, than the commonly adopted method of testing each metal with all the different reagents; in this latter case the student for the time being loses sight of comparative reactions).

The more thorough a student is in his work, the more he applies to it all his power of thought; the better his mind will be fitted to carry the science into practical work, should such be his ulterior aim. The more he works by rule, the less fitted will he be for more advanced work, and the less able to leave the beaten track.

The general principles here laid down in the study of chemistry, will be applicable to the other sciences. It will be better far for the student to cover less ground and to lay a thorough and thoughtful foundation; the further general knowledge of the subject will be easily and quickly gained whenever it may be desired. So too as regards the idea that a student should study at least a little of every science. To my mind it is better far to devote one's self thoroughly to one science or perhaps two in college; so similar are the methods of thought in them all, that he who has mastered one, can take up by himself any of the others sufficiently well to gain as much knowledge of it as a *liberal education* demands, while he who devotes himself in college equally to all will not only know little of any one, but he will almost, if not completely, have failed to gain the development of mind which science study should give him, and the superficial knowledge and facts gained will, for the most part, pass from his mind, as soon as examination day is over. With the scientific method of thought once gained, however, the facts in all other sciences, will naturally fall into such logical sequence that they will, for the most part, readily remain in the memory.

In summing up this paper let me repeat in conclusion that in my opinion, science study, to have its true value, must have ever before it from Common School to College, as its chief aim, the development of the power of thought; without this aim, it is time largely thrown away; with it, it is one of the most potent agencies in modern civilization.

JAS. LEWIS HOWE.

Polytechnical Society, Louisville, Ky.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

The Question of the Celts.

I REPLY with much pleasure to Professor Haynes's inquiries in *Science*, April 8, p. 207.

The theory of the European origin of the white race was advanced by Omalius D'Halloy (who is almost as well known for his labors in ethnology as in geology) in various papers published

previous to 1850 in the *Bulletins de l'Academie Royale de Belgique.* These must have been known to Dr. Latham, though he nowhere acknowledges indebtedness to them.

The work of Broca, in which he states that the Celts were a mixed type, is his "Nouvelles Recherches sur l'Anthropologie de la France." His words are, "C'est dans cette race mixte que se constitua plus de quinze siecles avant J. C. la nationalité des Celts."

In designating the ancient, blond, dolichocephalic people as Kymric, I follow the best French authorities, such as Dr. Collignon. The ancient Britons, Queen Boadicea and her subjects, were of this type. I cannot understand how Professor Haynes can say "all Celtic people now have black hair," in view of the type of the Scotch Highlanders and the Irish east of the Shannon. In reference to the invaders of Rome, I simply claimed that they spoke a Celtic dialect; I now go further and aver that, in the case of free tribes, speaking a dialect does prove blood relationship in all cases I know of. D. G. Brinton.

Philadelphia, April 19.

The Question of the Artificial Production of Variations in Type.

Attempts have been made to modify the forms of animals, or produce new species, by deforming the parent, e.g., in the case of the attempt to produce a breed of short-tailed mice by mutilating the tails of the parents. Is this not beginning at the wrong end? Are not all transmitted variations transmitted by parents which were modified before birth? All successful attempts to produce and transmit modifications in the breed being the result of breeding from animals that have been congenitally modified, would it not seem the proper and only method to study the laws governing the modifications of the embryo and having discovered these, the production of modifications in species would be a matter of slight difficulty. Congenital variations are the result of law and not of chance. Gerald M. West.

Clark University, Worcester, Mass., April 17.

AMONG THE PUBLISHERS.

Messrs. Macmillan & Co. have issued a second edition of Mr. A. R. Wallace's well-known "Island Life, or the Phenomena and Causes of Insular Faunas and Floras." The work has been carefully revised throughout, and, owing to the great increase in our knowledge of natural history of some of the islands during the last twelve years, considerable additions and alterations have been required.

— We have received a copy of the "Graphic Atlas and Gazetteer of the World," edited by J. G. Bartholomew, F.R.G.S., F.R.S.E., and published by Thomas Nelson & Sons. It is an entirely new atlas, with over 220 maps, charts, plans of cities, etc., all revised to the present date. A most valuable feature is the Gazetteer of of the World, with nearly 55,000 places, specially complete in American names, and results of new census. In the United States section a separate map is given of each of the States and Territories, specially compiled from the latest Government Survey Maps. In proportion to its contents this volume is quite unique among atlases for compactness and portability. It is of quarto size, bound in half-morocco, gilt top, and sold at the very moderate price of $7.50.

— Both admirers and critics of Spencer will be interested in the paper on "Herbert Spencer and the Synthetic Philosophy," in the May *Popular Science Monthly.* The writer, Mr. William H. Hudson, was formerly private secretary of Mr. Spencer, and gives an insight into the process by which his philosophic thought unfolded. The paper contains also a statement of the relation between the work of Darwin and that of Spencer. Professor Frederick Starr will contribute some "Notes upon Anthropological Work in Europe," telling what museums and other facilities for the study of anthropology exist abroad. The article is illustrated with twelve portraits of leading European anthropologists. "Cave-Dwellings of Men" is the subject of a copiously illustrated article by Mr. W. H. Larrabee. It relates not only to the ancient cave-dwellings of America and the Old World, but describes also the way in which modern troglodytes are living in several parts of Europe to-day. In an article on "Evolution in Folk-Lore," Mr. David Dwight Wells gives two versions of a negro legend nearly a century apart in time, which show the alterations produced in the tale by the change from free life in Africa to slave life in America. An Index to Volumes I. to XL. of *The Popular Science Monthly* is well advanced in preparation, and will be published in the course of the coming summer. The entire contents of the forty volumes will be entered both by author and by subject in one alphabetical list, and the Index will have all the most approved features of the latest magazine indexes, besides some novel ones. The compiler is Mr. Frederik A. Fernald of the editorial staff of the *Monthly.*

— *Nature* notices the appearance of a very useful work, in Russian, by Professor Samokvasoff, on Russian prehistoric antiquities, under the title of "Foundations of a Chronological Classification of Antiquities, and Catalogue." As seen from the title, the work consists of two parts: a catalogue of the very rich collection of the Russian professor, partly illustrated, and a general description of the various epochs which may be distinguished in the relics of the past on the territory of Russia. He has no difficulty in showing that the Slavonians of the first centuries of our era were by no means mere savages. The burial places of that period, usually situated close to the earthern forts, some of which must have required the work of a considerable population, contain hundreds and thousands of graves, so that it is certain that the Slavonians of that period were living in large societies, and had their fortified towns. The same burial customs prevailed over large areas, but the treasures now unearthed from various graves show that differences of wealth and social position existed at that time as well. Considerable amounts of Greek, Roman, and Arabian gold and silver coins were found in the graves, the metal alone of the coins found in some graves attaining, at its present prices, the value of several hundred pounds; while numbers of objects of art, of Greek, Roman, Byzantine, and Arabian origin, are proofs of the brisk foreign trade which took place at that time. The graves of the pagan Slavonians contain flax, woollen, silk, and gold-embroidered tissues; ornaments in gold, silver, bronze, and bone; iron weapons and parts of armament; gold, silver, bronze, iron, and clay vessels, and so on; while the sickles and the grains of wheat, oats, and barley which were found in the graves of South Russia, together with small idols and other objects devoted to pagan worship, are proofs of agriculture having been carried on during the pagan epoch.

INDUSTRIAL NOTES.

Scientific Improvements.

It has been the good fortune of an American firm, J. W. Queen & Co., of Philadelphia, to furnish an epoch-making contrivance for those who have to use the lantern at varying distances from the screen. The New Multifocal Attachment, which they have wisely protected by patent, is the most valuable accessory that has ever been offered to the exhibitor and lecturer. It consists of *an achromatic* combination of lenses which is placed just behind the ordinary projection objective. This new accessory, having been prepared after a special formula, is so delicately adapted to its work that its curves help to correct and improve the definition of the objective, but the principal purpose of this new accessory, as expressed by its name, *multifocal*, is to provide many points of image production in the range of the objective, each image point giving a different size of picture for the screen, according to the desired distance. In common experience the lecturer is obliged to set the instrument at one invariable distance from the screen, or else carry several screens of different sizes. Every one can appreciate the relief offered by the Multifocal Attachment, which allows complete liberty of choice for the station of the lantern with only one screen. The exhibitor can now literally "cut his coat according to his cloth," and diminish or increase the size of his picture so as neatly to cover the screen at any distance. It is simply impossible to express the satisfaction and freedom from care which the possession of

this admirable contrivance gives to one whose problem includes night after night the provision for work in halls of many dimensions. But besides having to carry screens of different sizes, the operator needed heretofore three or four pairs of objectives of different powers, a matter of great expense, besides the cumbersome task of packing and unpacking several sets of glasses.

The multifocal attachment not only dispenses with the burden and expense of additional objectives, but also furnishes a picture more nearly PERFECT than the best combination gives without it, never disturbing the equilibrium of the system of lenses, but adding new powers of definition with entire freedom from distortion of lines and color dispersion.

This attachment can be furnished in three graded powers to suit different objectives.

A varying size of picture on the same screen is sometimes desirable. When a portrait or statue is to be shown, it might be desirable to have it relatively larger or smaller than the scale of the landscape views. To effect this formerly required a change of objectives and an unpleasant interruption; but with the new attachment the statue may be shown life-size or colossal, and a portrait can be reduced to precisely the best size for life-like presentation.

The phantasmagoria effect with the MULTIFOCAL ATTACHMENT is now possible without moving the lantern backward or forward. Simply by increasing the distance of the multifocal system, the picture can be reduced to a disc of light of a few inches diameter, and slowly or rapidly enlarged to cover the whole screen. In scientific demonstrations the operator sometimes needs a sharpened pencil of light or a parallel beam. Such wants are readily met by this wonder-working improvement. All workers with the lantern should know about it, as they will appreciate what can be accomplished with it in covering all perplexities in the distance and size of picture on the screen.

See advertisement in another column.—*Communicated.*

CALENDAR.

Biological Society, Washington.

April 16.—C. W. Stiles, Notes on Parasites: Tænia ovilla in its Relation to Blanchard's Classification; F. V. Coville, The Flora of the High Sierras of California, New Plants from California, Nevada, and Utah; Erwin F. Smith, A Review of Baillon's Botanical Dictionary; J. N. Rose, Mexican Leguminosæ with Notes on Dr. Palmer's Collection.

Society of Natural History, Boston.

April 20.—John Murray, Some Recent Investigations into the Physical and Biological Conditions of the Locks and Fjords of the West of Scotland; E. Adams Hartwell, An Elevated Pot-Hole at Fitchburg, Mass.; George H. Barton, Additional Notes on the Drumlins of Massachusetts.

QUERY.

Can any reader of *Science* cite a case of lightning stroke in which the dissipation of a small conductor (one-sixteenth of an inch in diameter, say,) has failed to protect between two horizontal planes passing through its upper and lower ends respectively? Plenty of cases have been found which show that when the conductor is dissipated the building is not injured to the extent explained (for many of these see volumes of Philosophical Transactions at the time when lightning was attracting the attention of the Royal Society), but not an exception is yet known, although this query has been published far and wide among electricians.

First inserted June 19. No response to date.

N. D. C. HODGES,

874 BROADWAY, NEW YORK.

SCIENCE

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SCIENCE

NEW YORK, APRIL 29, 1892.

THE NEW METHOD OF PROTECTING BUILDINGS FROM LIGHTNING.

In this week's number we publish a letter on a case of lightning stroke, and would take occasion to suggest that it may help to clear up our ideas on these apparently erratic phenomena if we constantly bear in mind that the energy, just before a lightning flash, according to our present conceptions of electricity, exists in a more or less considerable mass of dielectric (the atmosphere and a portion of the earth), which includes the two points between which there is a difference of potential. In other words, if there is a difference of potential between a cloud and the earth the electrical energy exists diffused for the most part thoroughout a mass of air extending from the cloud to the earth, some, of course, existing in the surface layers of the earth. Now, when the flash takes place, all will agree that this energy manifests itself as light and heat, and in the knocking of things to pieces, perhaps.

We can but confuse our minds if we continue to think of the energy which causes the damage, or heat, or light, as coming from above or below, but should rather consider it as shrinking in, as it were, from all the circumambient dielectric to the places where it manifests itself as a heated line of air (the flash), or in the broken house-wall. The energy, which is what does the harm, comes, in the case of a vertical discharge not from above or below, but in the main horizontally. Do not let any one misunderstand me as saying that the electricity in such a case moves horizontally, for I do not. As I pointed out in my article in *Science* of April 8, I do not yet know of a case where the destruction, by the discharge, of a small conductor has failed to protect all else between two horizontal planes passing through the upper and lower ends of the dissipated conductor. It may be well to cite a few more cases of such protection resulting from the expenditure of the energy upon a small metallic conductor.

In the Philosophical Transactions, xlix., p. 298, is a paper read Dec. 18, 1755, by G. Brandir, Esq., descriptive of the striking of the Danish church in Wellclose Square, in which it is related that "on Monday, the 17th past, between six and seven o'clock, there was, among many others, one most amazing flash, accompanied with a clap of thunder, that equalled in report the largest cannon! That the next morning, observing the church clock to be silent, they went to the belfry, and found the wire and chain, that communicated from the clock in the belfry to the clapper in the turret, where the bells hang, to be melted; and that the small bar of iron from the clock, that gives motion to the chain and wire, just where the chain was fastened, was melted half through, the bar being about three-fourths of an inch broad, and half an inch thick. Several links of the chain, and of the wire, I have now the honor to shew you, where it will be observed, that the lightning took effect only in the joints. But whether it entered by communication from the wire exposed to the air in the small turret, through the roof of the belfry, or at the windows, there being several panes broke in the south and west corners, I cannot say; although I presume rather the first way, as it is very possible, that the bare report of the thunder might have occasioned the latter.

"The pieces of the wire and chain were scattered over the whole belfry, nor could it be discerned, that the wood-work, or aught else, had suffered."

There is a case cited in all the books on lightning, which is also interesting in this connection. The packet ship "New York" was struck by lightning April 19, 1827, while in the Gulf Stream. She was provided with a lightning rod, if it may be so called, consisting of a pointed iron rod one-half an inch in diameter and four feet long, at her mast-head, from which extended an iron chain, 130 feet long, to the sea. The links are described as one-quarter of an inch in diameter, whatever this may mean. It is evident, however, that the chain was not a heavy one and that, being a chain, it was a conductor of variable resistance, a condition well known to be conducive to destruction in case of the passage of a high-potential current. The rod was struck. A few inches of the terminal were melted, and of the chain all except three feet was dispersed. The important fact here as always, so far as yet known, is that no damage was done to the ship by the lightning.

My method of protecting buildings from lightning consists simply in placing on the building, from its highest to its lowest part, a small conductor of variable resistance, so as to make sure of its destruction in case the house is struck. And I base my confidence in its success on the fact that, exercising all possible diligence in the search through the records of actual cases of lightning stroke, I have not met with a case of failure of such a conductor to protect, when by accident it has been employed; and, further, I have failed to elicit any exceptions by the numerous methods of publi cation I have employed.

I employ one or two pounds of copper on a house of the ordinary size, and if anyone will take the trouble to calculate, according to the best data at our disposal, the energy dissipated in the evaporation of a pound of copper, he will understand how it is that there is none left to do further damage.

Another point which the records bring out, and which has been noted by others, is that damage occurs near large masses of metal. The small masses of metal, if not in confined spaces, burn as harmlessly as gunpowder on a sheeet of paper.

N. D. C. HODGES.

874 Broadway, New York.

SPANIARDS are making a good many preparations for the celebration of the four-hundredth anniversary of the discovery of the the New World. In the autumn of the present year, says *Nature*, there will be several exhibitions, in one of which will be shown objects relating to the continent of America before the advent of Europeans, while another will illustrate the state of civilization in the colonizing countries of the Old World at the time when the new continent was discovered. In October the Congress of Americanists will meet at Huelva, and will discuss a variety of subjects relating to the continent of America and its inhabitants 400 years ago. In the same month, at Madrid, a Spanish Portuguese-American Geographical Congress will meet for the discussion of such questions as relate more particularly to the "Iberian-American" races, their aptitude for colonization, and the future of the Spanish language.

COLLECTING GORILLA BRAINS.

AT A recent meeting of the Academy of Natural Sciences of Philadelphia, Dr. Henry C. Chapman described three gorilla brains collected by the Rev. R. H. Nassau, D.D., in 1890, upon the Ogove River, West Africa. The brains have heen presented by him, through Dr. Thos. G. Morton, to the academy. Dr. Chapman's observations upon these brains are embodied in a paper now in the course of publication in the Academy's Proceedings. At the close of Dr. Chapman's communication, Dr. Nassau related his experiences when obtaining the brains. The appended extracts are from two letters written by him to Dr. Morton in 1890, in which he tells the story of the two expeditions he made to obtain them. The extracts have been made by the kind permission of these gentlemen. JAS. E. IVES.

TALAGUGA, OGOVE RIVER,
GABOON AND CORSICO MISSION,
WEST AFRICA, MARCH 7, 1890.

I made all plans with great forethought as to details; the season would be cool and dry, when I could hunt with less discomfort; no flooded low grounds; a large proportion of the leaves fall in the dry season, leaving the thickets less dense and giving better chance for spying animals. There are scarcely any gorillas in this Talaguga region; I have known of but two being killed during the eight years I have been here. So I closed my house and went down the seventy miles to Kângwe. There I chose a good crew of eight young men. Four carboys of chloride of zinc had been carefully kept all these years; I took a jugful of it. Not to waste my alcohol (in which was to be immersed the brain as it should finally go to you), I took along several gallons of rum. . . . Proper receptacles were taken for receiving the brains. I took my Winchester and double-barrelled gun (suitable for either shot or bullet), and invited with me one of our French associates, M. Gacon, a Swiss sharpshooter, who had the latest Swiss army breach-loading rifle. For the native hunters I took two of the best (very poor at best) flint-lock muskets from the Trading House, good for two weeks, etc.

From this point I will copy from my diary written at the time.

"Wednesday, July 17, 1889. Rose early and by 9 A.M. were at our destination. M. Gacon, after our noon meal, impatiently went out to hunt with Ogula. They returned having seen signs of gorillas, but not having seen the animals themselves. A council was held in the evening with the villagers as to time, routes and the art of hunting a gorilla. Everybody was sure I should not be in the village four days without succeeding; they told wonderful stories of the numbers and audacity of the gorillas, that not two days passed but that somebody saw them in the gardens. As the garden work is done principally by women, it was they who most frequently saw them, sometimes actually meeting them in the path and being pursued by males. From all their accounts the gorilla is full of the arts and tricks of the monkey tribe, quick to read faces. The women being unarmed and afraid, the animals were more daring to them than to men. But they all said that we white people would have no chance of getting so near, that the animils would detect our strange odor and fear our white faces. They hoped we would kill many, for their gardens were devastated by gorillas, pigs, oxen and elephants. Most of the men said that though they often saw these animals, they were afraid to shoot with their flint-locks that often uncertainly flashed in the pan or whose slug-shots were not immediately fatal; that then they were at the mercy of the wounded beasts. They warned us, if we met with a male gorilla who dared to face us, not to fire till only a few yards distant, and, even then, not to aim at the head, for the animal had the art, being acquainted with guns, and all have informed each other (so the natives believe), of ducking down its head at the click of the trigger. We were to aim at the abdomen, which from its size could not fail to be injured, and the head or chest would probably be pierced by the animal's having ducked its head down to dodge a shot aimed, as it supposed, at its head.

"Thursday, July 18. We all went, some fourteen men and eight dogs, in the boat to a large island shortly after sunrise. My own crew of six were afraid and I left them in the boat, and Ogula described the lie of the land so that they were to follow around to another part where we should probably emerge. The rest of us entered the thicket, very dense; it grows up so wherever there are abandoned plantations. The original forest is easily threaded, for the dense foliage of the tall trees kills out by its shade the underbrush. But the gorillas are looked for mostly in the plantations, old and new. But after four hours of search nothing was heard or even seen except the tracks of the wild pigs. In the afternoon Okendo, whose plantation was on another part of the island we had been at, came in frantic haste saying a gorilla was just seen by his wife. We went. Sure enough, there were the pieces of sugar-cane the beast had chewed and spat from his mouth, still wet with spittle, and the broken branches of cassava marked his exit from the garden. We divided into three companies, to the right and left and centre. I was in the centre with Osamwamani. M. Gacon went with Ogula to the right. Ogula was the only one who saw the gorilla, a female; but it disappeared before he could draw on it. This stimulated our plans that night for the next day's work.

"Friday, July 19. M. Gacon started in a canoe with three men at 5 A.M., and I followed an hour later in the boat with my crew and four men, the crew as usual awaiting us in the boat. We went in the general region of the previous afternoon; there were frequent and fresh signs, dung still warm. The thicket was impossible to be passed by a human being in any other than the too noisy way of cutting with the long knives we carried, or by crawling on our bellies under the mass. The mass of vines, bushes and, worst of all, a grass growing many yards in length whose long, narrow leaves were, on their edges, as sharp as knives. The density of this growth above killed out the leaves lower down, and the thicket was tunnelled with many passages, intersecting and opening out into spaces of a square rod or two where might be a clump of trees, and where the animals had their sleeping places on the lower branches. You perceive that even if a gorilla was heard or sighted in such a thicket while we were crawling on our bellies, it could get away before we could snatch our gun into position, and, if the animal should only be wounded, we should be in a very ugly place for defending ourselves. The trail became so hot we were sure the animal was near. We divided, M. Gacon going with Ogula to one side and I and Osamwamani to the other. Suddenly we heard the dog Hector barking sharply, and shortly after the screams of a baby gorilla. The noises did not seem to be more than forty or fifty feet from us; we could *see* nothing. The barking became more savage, the screams more agonized, and, as we tore our way through the thicket, there was added the angry howl of a

parent gorilla. Everybody took his own way, losing sight of each other, following the sounds, along our several radii, to the fierce centre. But the bark ceased with a yelp; the screams and howl rapidly receded, faster than we could follow. I emerged into a small open glade, where stood Ogula, M. Gacon and Hector. The dog had come upon a mother and child at the foot of a tree in a hollow, which was still warm. The mother had fled at first sight, but had returned at the screams of the child, which the dog had seized. It was just at this moment that M. Gacon and Ogula saw them. The mother slapped the dog with her hand and the dog dropped the child with a yelp of pain. Ogula allowed the precious moment to pass, fearing to kill the dog with the slugs of his musket. M. Gacon was in his rear and emerged on the scene just as the mother, who had picked up her child, disappeared. He had not a moment's time to get his rifle into position. On our way back to the boat we came to a large glade, where evidently there must have slept that very night not less than twenty gorillas. It was exasperating that we had been only a few hundred yards from that spot the afternoon before and that very morning. All our hands and faces were cut and bleeding by the fearful grass in that frantic rush, and I had hurt my knee by a fall over a log. So we rested and mended ourselves during the afternoon in the village.

"Saturday, July 20. We all rose at three A.M., and, volunteers and all, went to a new place, where on the previous day a large male gorilla had been reported. I did not like the plan, I wanted to go to yesterday morning's region; but Ogula was overpersuaded by the volunteers. Their plan was to form a line across the long point on which the animal had been heard on the previous afternoon. We entered the forest in the dark of the morning. I am not accustomed to such exhausting work before breakfast, and when, after a fruitless search, we emerged again, I was provoked to find that three old volunteers had changed their minds, had not followed us, and were resting comfortably on the sandy beach munching peanuts.

"Monday, July 22. M. Gacon went out with the hunters to a new place, where a gorilla had been heard on Sabbath, but they returned fruitless; M. Gacon had shot a flying squirrel. He went out again in the afternoon alone, but saw nothing.

"Tuesday, July 23. Ogula and Osamwamani, ashamed over our ill-success, declared I should have a gorilla that very day, and went without us before daylight to a distant place. They returned in the evening having seen many gorillas, some of which had taken refuge in high tree-tops beyond the range of their muskets. They regretted not having taken us along. We gave up the search for a gorilla. My knee was still inflamed and M. Gacon's enthusiasm waned. We could not deny that there were gorillas in abundance, but the difficulties in obtaining them were just as obvious"

During all these years from 1882 to 1889, while I was prevented from hunting myself, I had employed a hunter, Azâze, living at Orânga, about 35 or 40 miles down the river from Kângwe, promising him a good reward if he brought me a dead gorilla in good condition. To get it to me in good condition at Kângwe he would have to start immediately and pull day and night. He brought two carcasses here while I was away at Talaguga some years ago, and they were lost, there being no one here to open a skull carefully. He sent a third, a small one, just a year ago. It reached me here just as I was starting up to Talaguga. I had actually stepped into the boat and in five minutes should have started. The messenger had arrived during the night, but had taken his leisure to deliver it. I would have stopped the journey, but the carcass was then spoiled, and what I would have given a large sum for twenty-four hours earlier I threw into the river as worth nothing. His last effort was eight months ago, the week before I went on the hunt to the lake. It was a very large old male. Azâze had made a desperate effort to reach here with it safe. He arrived on a Sabbath noon. I did not go to the water-side to see it, my principles would not allow me to work on it on the Sabbath; but early Monday A.M. I got the brain out, but it was then too soft.

KANGWE MISSION STATION, OGOVE RIVER,
WEST AFRICA, October, 2, 1890.

This year in July I went again to another part of the same lake, Kângwe, and hired two native Bakele hunters. They saw in two days' hunting both elephants and gorillas, but failed to kill any. But some Galwa young men, knowing my errand, went out on their own account and found five gorillas, an old male, three females, and a stout grown lad. The place was in sight and gun-sound of the village where I was waiting across one of the beautiful bays of the lake. The females fled; the old male showed some fight, but fled when the lad was shot. The carcass was brought to me still warm. I had a carpenter's back-saw and a chisel, I worked with care; but in my anxiety at the last I gave an unfortunate blow or two and wounded the brain, and much of it exuded under the astringing influence of the chloride of zinc; also, I had no alcohol and had to use trade rum, and I fear that the brain has not been kept by it from decay. A few days later, I by a very, very rare chance bought two gorilla male children; they were in good condition and tamed. The servant in whose care I left them at this place, Kângwe, during a few days' absence neglected them and they were attacked by "driver" ants the night of the day before my return. One survived twelve and the other forty-eight hours. Their cries for help had been disregarded, and when I discovered them they could only moan. I combed thousands of ants off of them. That servant of mine had also neglected to feed them, and they were partly starved before the ants attacked them. The second of these I finally killed, seeing it was dying; and, working very carefully with the chisel, using no mallet, loosened the brain without injuring the membranes. I was afraid to work down toward the base of the brain, so I left it adhering and sawed away the face so as to make the mass small enough to enter the jar. I enveloped it and also the first brain in separate muslin bags so that they should not abrade each other.

That attack by driver ants was made at this house, Kângwe; and one of the little fellows, the one that I finally killed, was still living next day when I started up river by my boat to my Talaguga home, 70 miles, a four days' journey. It died at night at my first camp on a sand-bar in the river, and I did the work at midnight by torch-light. I put the brain in the chloride, and on arrival at my house three days later, put it into rum. R. H. NASSAU.

NOTES AND NEWS.

IN connection with the celebration of the fourth centenary of the discovery of America by Columbus, the Italian Botanical Society, says *Nature*, invites the attendance of botanists of all countries at a Botanical International Congress, to be held at Genoa, from the 4th to the 11th of September. In addition to the meeting for scientific purposes, there will be excursions on the shores of the Mediterranean and in the Maritime Alps; and during the same time will also take place the inauguration of the

new Botanical Institute built and presented to the University of Genoa by the munificence of Mr. Thomas Hanbury, of La Mortola, and the opening of an Exhibition of Horticulture. All communications should be addressed to Professor Penzig of the University of Genoa.

—In the Annual Report for 1892 of the Berlin branch of the German Meteorological Society, Professor G. Hellmann gives an account of his continued experiments, which are summarized in *Nature*, on the effects of exposure on rainfall records, and on the determination of the distance apart that rain-gauges should be erected in order to obtain an accurate account of the rainfall of any district. Simple as the question appears, the experiments, which have been carried on for seven years, have not sufficed to give a definite answer. Very considerable differences are found in the amounts recorded at stations comparatively close to each other. This result is partly owing to the effect of wind, especially in the case of snow. The following are the most important conclusions derived from the experiments: (1) The more a rain-gauge is exposed to the wind, under otherwise similar circumstances, the less rainfall it records, and the higher a gauge is placed above the ground, the less rain it catches, as the disturbing influence of the wind is greater than on the surface of the ground. But if protected from the wind, a gauge will give useful results in an elevated position. The usual instructions to erect the gauge as openly as possible are therefore incorrect. (2) Even in a flat country, differences of 5 per cent occur in different months, at stations a quarter of a mile apart; in stormy weather, especially during thunderstorms, the difference may amount to 100 per cent. The amounts recorded at neighboring stations agree better together in spring and autumn, and also in relatively wet years. Further experiments are needed, if possible by means of anemometers erected at the same level as the rain-gauges, to determine more accurately the effect of wind on both rainfall and snow.

— At a meeting of the Engineers' Club of Philadelphia, April 2, Mr. W. S. Auchincloss read a paper on Yearly Tides. In this paper the author stated that he proposed to show that confined bodies of fresh water are subject to yearly tides of greater or less magnitude, depending upon the nature of the basin or upon the strata to which they are confined, and upon the effect of evaporation if in an open basin. In March, 1885, he had occasion to sink a well near Bryn Mawr, Pa. Natural anxiety as to the permanence of the supply led him to observe the depth of the water at intervals of about ten days. It soon became evident that the water was receding. In 1886 there was a gratifying rise of the surface and a total gain of 12 feet. His curiosity was aroused and he determined to study the law, if such a law existed, of this ebb and flow. These observations have been continued during the past seven years. He found that in normal years the surface of the water reaches its lowest level in December, rises until June, and descends during the autumn. An examination of the amount of the rainfall shows that while the amount of rainfall was as great or greater during the last half of the year as during the first, the level of the water in the well continually lowered. Atmospheric temperature had practically no effect, as the temperature of the water in the well is practically constant all the year round. The depth of the well prevented evaporation from its surface from having any effect. The author believes that the true cause is the result of the influences of gravity and of the sun's attraction at different seasons of the year. When the sun reaches its furthest point south of the equator, gravity exerts its maximum influence on the waters of the northern hemisphere. The waters of the earth will be drawn into the minutest crevices and the surfaces lowered, but in June they will, in a measure, be released, and, under the influence of adhesion and friction, will be held at a higher level than during any other season of the year. Data obtained from the Government records, showing the depth of water in the Great Lakes, show that there is a similar rise and fall, the range of yearly ebb and flow being from 12 to 15 inches in our northern lakes. So far as we are aware, no data exist for the small lakes. More extended research will, we believe, secure as complete a recognition of yearly tides as physical geography has always accorded to the phenomenon of daily tides. The author presented two diagrams, one of which showed the rise and fall of the water in the well covering a period of seven years, and also the northing and southing of the sun for the same period.

— In February, 1890, a grant was made by the Royal Society for the purpose of supplying the Ben Nevis Observatory with apparatus for counting the number of dust-particles in the air. Two instruments, one portable and another of larger dimensions, were made after designs by Mr. Aitken. With the latter observations may be made at any time, except when the wind, blowing from the south-west, pollutes the air above the inlet pipes with smoke from the observatory and hotel. Since February, 1891, observations have been made every third hour. Some of the results are given, and their bearing discussed, by Mr. Angus Rankin in the *Journal of the Scottish Meteor. Soc.*, Third Series, No. viii. It may be stated that a number of particles under 100 in a cubic centimeter of air is phenomenally small, and a number over 4,000 phenomenally large. The highest number was 14,400, which was counted in April, 1891. The particles are most numerous during March, April and May, when easterly and south-easterly winds are prevalent both at sea-level and on the summit of the mountain. On the other hand, when the winds on Ben Nevis blow from the north-west, north, or east, their directions diverge most from those of sea-level winds, and then the dust-particles are most scarce. Hourly observations were made only on four days, but the three-hourly means show the general trend of the daily curve. The means for the three months, March to May, show a minimum, 526, at 4 hours, and a maximum, 1,488, at 16 hours, the absolute mean for the three months being 854. The variations seem to be due to the movements of the first, or lowest, cloud stratum. In the morning this stratum lies below the summit of Ben Nevis, but towards noon rises and envelopes the top, hovers above it in the afternoon, and sinks to its original position about midnight. Several points remain to be cleared up. Apparently only the free dust-particles are counted, and few, if any, of those on which moisture has condensed to form visible fog; all the lowest values have been recorded when a thin mist enveloped the top. These observations will be of great service in the study of clouds—their forms, heights, and motions. The bearing of dust on the humidity of the air is also an important point; at present the humidity of the Ben Nevis atmosphere is very little understood.

— The papers entered to be read at the April meeting of the National Academy of Sciences were as follows: An American Maar, by G. K. Gilbert; The Form and Efficiency of the Iced Bar Base Apparatus of the United States Coast and Geodetic Survey, by R. S. Woodward (introduced by T. C. Mendenhall); On Atmospheric Radiation of Heat in Meteorology, by C. Abbe; On the Deflecting Forces that Produce the Diurnal Variation of the Normal Terrestrial Magnetic Field, by F. H. Bigelow (introduced by C. Abbe); Abstract of Results from the United States Coast and Geodetic Survey Magnetic Observatory at Los Angeles, Cal., 1882-1889, Part III., Differential Measures of the Horizontal Component of the Magnetic Force, by C. A. Schott; On the Anatomy and Systematic Position of the Mecoptera, by A. S. Packard; On the Laws of the Variation of Latitude, by S. C. Chandler; On the Causes of Variations of Period in the Variable Stars, by S. C. Chandler; On the Force of Gravity at Washington, by T. C. Mendenhall; On the Recent Variations of Latitude at Washington, by T. C. Mendenhall; On the Acoustic Properties of Aluminum, with Experimental Illustrations, by A. M. Mayer; Disruption of the Silver Haloid Molecule by Mechanical Force, by M. Carey Lea (introduced by G. F. Barker); On the Homologies of the Cranial Arches of the Reptilia, by E. D. Cope; On the Osteology of the Genus Anniella, by E. D. Cope; The Astronomical, Geodetic, and Electric Consequences of Tidal Strains within an Elastic Terrestrial Spheroid, by C. Abbe; Asiatic Influences in Europe, by E. S. Morse; Exhibition of Chladni's Acoustic Figures Transferred to Paper without Distortion, by A. M. Mayer; On Electrical Discharges Through Poor Vacua, and on Coronoidal Discharges, by M. I. Pupin (introduced by T. C. Mendenhall); Biographical Memoir of William

Ferrel, by C. Abbe; A Definition of Institutions, by J. W. Powell; Biographical Memoir of J. Homer Lane, by C. Abbe; The Partition of the North American Realm, by Theodore Gill; Exhibition of Teeth of a Gigantic Bear, Probably an Extinct Species, Found in Ancient Mounds in Ohio, by F. W. Putnam; A Means of Measuring the Difference Between the Tidal Change in the Direction of the Plumb Line and the Tidal Deflection of the Earth's Crust, A Posthumous Paper by J. Homer Lane, read by C. Abbe.

— Mr. Timothy Hopkins has made provision for the endowment and maintenance of the seaside laboratory at Pacific Grove, recently established under the auspices of the Leland Stanford Junior University. It is intended to make this a place for original investigation of the habits, life-history, structure and development of marine animals and plants and to carry on work here similar to that which is done at the acquarium at Naples. The Hopkins Laboratory will be under the general direction of Professors Gilbert, Jenkins, and Campbell. It will be open during the summer vacation, and its facilities will be at the disposal of persons wishing to carry on original investigations in biology, as well as of students and teachers interested in that line of subjects. It will be fully provided with aquaria, while microscopes, microtomes and other instruments necessary for investigations will be taken from the laboratories of the University.

— At a meeting of the Epidemiological Society (*Lancet*, Feb. 29, 1892) Dr. Pringle quoted a remarkable passage from an ancient Hindu work, which showed that true vaccination was known and practised in India centuries before the birth of Jenner: "The small-pox produced *from the udder of the cow* will be of the same mild nature as the original disease. . . . The pock should be of a good color, filled with a *clear* liquid, and surrounded by a circle of red. . . . There will be only slight fever of one, two, or three days, but no fear need be entertained of small-pox so long as life endures." Pasteur's attenuation of virus by successive cultures has been applied in India for hundreds of years to inoculations with variolous lymph, which the document in question directed to be taken from "the most favorable cases," and he has seen series of such selected inoculations in which there was no general eruption, and the local phenomena were scarcely distinguishable from those of vaccination.

— In a paper, in the April number of the *Botanical Gazette*, on "Some Fungi Common to Wild and Cultivated Plants," Byron D. Halsted, Rutgers College, New Brunswick, N.J., says: "It has been shown by means of a long series of examples that the evil influences of wild plants may act at long range. It is not necessary that their roots and those of the cultivated plants should cross each other's paths in the soil or that their branches should interlock and overshadow one another in a deadly embrace. There is a more subtle bad influence than gross thieving or clutching by the throat. It is more in the nature of a poison that is sent out upon the air to be breathed in by the innocent wherever they may unwittingly meet the unseen but deadly germs. Crowding of plants is bad, rank growth of weeds is worse, but the most fatal of all influences is that unseen group that steal away the health of the plants which lack nothing for room and enjoy high and thorough culture. After all it is the host of enemies that swarm from the plants outside the garden fence that try the patience of the husbandman. He has learned the methods of remedying the others, but the floating spores defy his keenest eyesight to discern and baffle his ingenuity to combat. The ways of the fungi are, however, being slowly and laboriously revealed by the microscope and conquered by the spraying pump. The former assists the latter, which as yet blindly fires effective "small shot" into the enemies' ranks. Proper seeding, fertilizing, and weeding will do much to assist in warding off the deleterious influences of fungous enemies; for healthy plants, while not proof against their attacks, are less liable to be overcome by them. Let therefore everything be done that is possible before the last resort comes and then the fungicide will have the greatest effect and yield the most returns. If so much of the smut, rust, mildew, mold, rot, and blight of our cultivated plants is propagated by the wild plants hard by, it may be wise for every crop-grower to pay attention to what is thriving outside his garden wall. He cannot build it high enough to shut out the spores, but he can do much to diminish the number of these spores. Having done this, he can take up the spraying pump with a brighter hope of future success. There was a carcass, so to speak, in the pasture and he went out and buried it. Fungi are the basis of contagion and they infect at long range by means of their myriads of invisible spores. To learn of their ways and find better methods of resisting them make the burden of many a station botanist's labor to-day."

— At the Washington meeting, Thursday, April 21, of the National Academy of Sciences Dr. Karl Barus, Professor Samuel F. Emmons and Mr. M. Carey Lea were elected members of the academy. Dr. Barus is connected with the United States geological survey, and is well known as a physicist. Professor Emmons is also connected with the geological survey and is a geologist. Mr. Lea is a Philadelphian, and is famous as a photographic chemist. The academy elected four foreign associate members. They were Professor Hugo Gylden of Upsala, Sweden; Professor Carl Weierstross of Berlin, Germany; Professor August Kekule of Bonn, Germany; and Professor E. Du Bois Reymond of Berlin, Germany.

— "On the Track of Columbus," a paper by Horatio J. Perry, is one of the features of the May *New England Magazine*.

— Professor N. S. Shaler, whose articles in *Scribner's*, on "The Surface of the Earth" and "Nature and Man in America," have done so much to make clear the practical features of geology and geography, begins in the May number of that periodical a group of four articles on Sea and Land, in which he will discuss Sea-Beaches, The Depths of the Sea, and Icebergs.

— Some time ago *Public Opinion*, the eclectic journal of Washington and New York, offered $300 in cash prizes for the best three essays on the question "What, if any, changes in existing plans are necessary to secure an equitable distribution of the burden of taxation for the support of the National, State, and Municipal Governments?" The competition has attracted much interest, and the committee, consisting of Hon. Josiah P. Quincy of Boston, Hon. Jno. A. Price, Chairman National Board of Trade, and Mr. W. H. Page, Editor of *The Forum*, have just awarded the first prize to Mr. Walter E. Weyl of Philadelphia; the second to Mr. Robert Luce, editor of *The Writer*, Boston; and the third to Mr. Bolton Hall of New York. The successful essays will be published in *Public Opinion* of April 28.

— "French Schools through American Eyes" is a report to the New York State Department of Public Instruction by J. Russell Parsons, Jr., the same gentleman who not long ago made a similar report on the German schools. Mr. Parsons remarks in his preface that "the belief that everything American is perfect constitutes a false form of patriotism which seems to be growing in this country;" but he maintains that in educational matters we have much to learn from foreigners. France, he thinks, has during the past twenty years made great advances in primary education, and now has some of the best public schools in the world. These schools he describes at considerable length, treating of their legal status and obligations, their organization, the method of selecting teachers, the methods of inspection, the courses of study, and many other aspects of the complex subject. His liberal use of statistics and the dryness of style characteristic of government publications make his book rather dull reading except to those especially interested in its theme; but to such persons it will convey much useful information. The most interesting part of it to the general reader is that which describes the courses of study in the various schools. The object sought by the French authorities is to teach those subjects that every person ought to know and to teach them in the most thorough manner possible. Moral education, too, receives special attention, and is so conducted as not to interfere in any way with the religious beliefs of either the children or their parents. Mr. Parsons gives tables showing the courses of instruction in several of the schools, which, however, we have not space to summarize. The book is published by C. W. Bardeen of Syracuse, N.Y.

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THE DETECTION OF ARTIFICIAL (IMITATION) GEMS.

IN most works on gems much stress is laid upon "hardness" as a means of distinguishing real from artificial "stones." Having had occasion during the past two years to examine several emeralds, rubies, etc., as to their genuineness, I have come to the conclusion that this property — which is, as everyone knows, of great assistance in the determination of uncut minerals — is of very little value in the examination of cut and polished gems, inasmuch as cutting a stone renders its surface much softer — in some cases reducing the hardness by over one-tenth — so that it can be "scratched" by minerals considerably lower in the scale of hardness than itself in its natural condition. On the other hand, many artificial gems will scratch ordinary window-glass quite readily, and have a hardness nearly equal to that of quartz, although it is popularly believed that if a "diamond" scratch glass it must be real.

Polishing the surface of a stone also necessarily affects its specific gravity, especially if the specimen be of small size, as is the case with most gems. Specific gravity as a means of detecting false gems is also rendered practically valueless by reason of the fact that special care is often taken in the manufacture of these articles to make them have specific gravities as nearly like the natural species which they are intended to imitate as possible.

Gems being usually much facetted, an examination of their optical properties becomes difficult and is of very little use in their practical determination.

Many gems are thought by their owners to be genuine on account of their having been in the possession of themselves or families as heirlooms for many years. Age in this case is no criterion as to value, as it is well known that the ancient Egyptians and Greeks were well versed in the manufacture of artificial stones.

The grand and really only reliable test, it seems to me, as to the genuineness or otherwise of a gem — in case we do not wish to totally destroy the specimen — is an examination of its fusibility. Artificial diamonds, emeralds, etc., if held in the border of the flame of a spirit-lamp or Bunsen burner soon become rounded on their edges, their fusibilities being generally considerably under three, according to von Kobell's scale of the fusibilities of minerals. The real stones, diamonds, etc., with the exception of the garnet, are practically infusible.

Great care should be taken in the examination of the fusibility of a gem, as, if the latter be genuine, it may, unless heated gradually and carefully, crack and fly to pieces on exposure to a high temperature. Moreover, some gems will change color if heated too highly.

W. G. MILLER.
University of Toronto.

THE SYSTEMATIC POSITION OF THE DIPTERA.

HAVING been a student of the Diptera for two years, I have come to the conclusion that the order is entitled to the distinction of being, as a whole, more highly specialized than any other. Entomologists who have attempted a general classification of insects have almost uniformly regarded the Hymenoptera as the highest order, placing the Lepidoptera second, and the Diptera third. The only exception in America, I believe, is Professor Hyatt, who, in a recent book ("Insecta," by Alpheus Hyatt and J. N. Arms), has placed the Diptera at the head of the class, with the Hymenoptera second, and the Lepidoptera third. His argument for this arrangement is brief and forcible. The main features may be summarized as follows: —

The essential question which settles the rank of any insect is, How far does it deviate in structure, and through what line of descent has it developed, from its Thysanuriform ancestors? To introduce the subject of instinct or of usefulness to man is to confuse our ideas, for we cannot translate the data furnished by such a criterion into terms of the other standard. Applying this principle, he takes the following features of Diptera to show that they possess a degree of specialization surpassing any other order: —

1. Larval structure: "The young of even the generalized forms of Diptera are, as a whole, farther removed from the Thysanuriform type than those of any other group. The secondary larval form, which in the case of the Diptera is always footless and often an almost headless maggot, has complete possession of the younger stages. As Friedrich Brauer has pointed out, the general absence in the larvæ of Diptera of the thoracic legs, even although living in situations that seem to demand their development, shows that they must have inherited this peculiarity from an ancestral form whose larva had lost them. This comparative inflexibility of the larval stage is sufficient of itself to show that there is now a wide gap between the existing Diptera and all other orders of insects, and that this chasm is not closed by the resemblances of the parts in the adult to those of the Lepidoptera or isolated forms in other orders" (pp. 273, 274).

2. The presence of but two wings: "The tendency to the enlargement of one pair of wings, like the tendency to the enlargement of certain pairs of thoracic legs and the reduction of other pairs, or a change in their structure and function, so that the insect makes a departure from the conventional normal type of four equal membranous wings and six equal-jointed legs, is everywhere an index of specialization" (p. 274).

3. The mouth parts are developed for sucking only.

4. The attachment of the abdomen to the thorax in some flies shows that they once possessed a pedunculated abdomen, similar to that of Hymenoptera (p. 251).

Of these features, the first is the most weighty. Had not its importance been overlooked, the order could never have been thought inferior to the Lepidoptera, of which the members have while larvæ thoracic legs and usually abdominal ones also. Among the Hymenoptera, the Tenthredinidæ have thoracic legs and even more numerous abdominal ones than the Lepidoptera. The Uroceridæ also have rudimentary thoracic legs, although the larvæ are borers in wood.

The second and third arguments are essentially one in principle. In the lower winged insects, we find both pairs of wings of equal size and importance. The Hymenoptera show a condition in which the hind wings are much smaller and so of less use. Now, why do not the Diptera represent the extreme of this series? The question is not whether two pairs of wings or one pair are in themselves "higher;" it is rather, Which type shows the greater departure from the forms universally acknowledged as ancestral? So regarding the mouth development: If the mandibular mouth of Thysanura, Odonata, etc., be admitted as representing the ancestral form, then surely the mouth combining mandibular and suctorial apparatus is intermediate, and that with only suctorial organs is the ultimate degree of specialization. The recent researches of Dr. John B. Smith (Trans. Am. Ent. Soc., XVII.) show that true mandibles are almost never present in Diptera (he found them only in Simulium). Although his conclusions in this respect, as well as in regard to the homologies of the dipterous mouth in general, are widely different from those of earlier investigators, they are probably correct. In summing up, he says (p. 339), "The development required is simply a further development of the line started in the Hymenoptera."

An argument that strongly reinforces the first one above is found in the fact that the embryo in Diptera, at least in the higher forms, does not develop any traces of legs, differing in this respect from even the highest Hymenoptera, which first develop the legs and then reabsorb them before hatching (*Psyche*, June, 1891, p. 98).

The subject of mimicry also throws some light on these relations. As is well known, the Diptera afford many interesting cases of mimicry, and it is important to our theory to notice that they generally imitate the Hymenoptera, especially the very highest forms, such as wasps, humble-bees, and even honey-bees. One of the most widespread of all species, *Eristalis tenax* Linn., is such a good imitation of the honey-bee as to deceive the very elect. One of my students, an enthusiastic collector and well acquainted with this case of mimicry, once grasped a bee in his hand, under the impression that he was capturing one of these flies. Now, on any theory, we must admit that these species of flies are of more recent origin than the species which they mimic. Most of these imitative flies belong to the family Syrphidæ, which is considered to be one of the oldest of the group Cyclorrhapha, comprising the higher flies.

The Diptera, as a whole, are wonderfully rich in peculiar modifications of structure. In almost any organ the variety of forms exceeds that of any other order. Even the antennæ of beetles do not surpass, if they equal, those of flies in this respect. The wings are far more variable in venation than those of any other order. The variety and complexity of organs for grasping the female are almost beyond belief to one who has not seen them.

The one thing which has prevented the recognition of the real rank of the Diptera is a lingering notion that specialization by reduction really brings an insect down to a lower position in the scale. The word "high" suggests the idea of "complete," or "perfect," or "typical." If Professor Hyatt's test were to exclude every other, as it ought to, there could scarcely be any further disagreement on the question of the highest order.

The line of argument here suggested points to the Pupipara as the highest of all insects; nor would I in the least seek to evade the conclusion. Of the group, I have seen only the Hippoboscidæ; among these the sheep tick, *Melophagus ovinus* Linn, appears to deserve the highest rank.

J. M. ALDRICH.

DEBLOOMING MINERAL OILS.

It is a common practice with dealers in mineral lubricating oils and what are known as wool-stock and neutral oils to add certain chemicals to these oils to destroy the bluish fluorescence or "bloom." The bloom on ordinary refined kerosene is very noticeable, while paraffin oil, i.e., oil that has been distilled from petroleum tar, or residuum, is intensely blue. A good way to see the bloom of an oil is to view it through the ordinary four-ounce sample bottle. These bottles are made with straight sides and of white glass. A test-tube answers very well. The bottle should be held in front of a window and viewed through the bottom.

If a drop of oil be put on a piece of black glass, or on a piece of window-glass painted black on the bottom, the bloom will show even when the oil appears bloomless in the bottle. The bloom of oils may be destroyed or masked by nitric acid, nitro-benzol, di-nitro-naphthalene, and some other nitro-compounds. The use of nitric acid, of course, destroys the oil for lubricating purposes.

The di-nitro-naphthalene of commerce is a very efficient deblooming agent. I found, however, that if this material be washed in hot water until the free acid and free nitro-benzol (?) be washed out, it loses its deblooming properties.

A small percentage of oil of myrbane added to wool-oil or neutral oil will destroy or mask the bloom altogether. At the same time it, like the di-nitro-naphthalene, darkens the oil, and gives it the odor of benzol.

The usual practice is to add a quantity of di-nitro-naphthalene to a portion of the oil to be treated, warming it gently meanwhile, and then, when the oil is about to be sold, to add this strong solution to the bulk of the oil. This is done because the nitro compound is liable to crystallize out in the cold, and also to stain yellow the containing vessel and to darken the oil on standing.

If a bright piece of steel be put into oil containing much di-nitro-naphthalene the steel becomes corroded. It will be readily seen that such oil is unfit for lubricating purposes. If the oil be filtered while cold, fine crystals of di-nitro-naphthalene will collect on the filter, and at the same time the filter is stained yellow. The bloom reappears in the filtered oil, showing that the bloom was only covered up and not destroyed.

The only safe and proper way to bleach and debloom oil is to expose it to the sun and air for a long time — two or three weeks or so — depending on the weather. By this method no deleterious substances are added to the oil, while at the same time it is rendered sweeter in odor and the "body" is somewhat increased. The bleacher consists of a shallow tank, sometimes covered with glass, but more generally exposed to the sun and rain. Into these tanks a few

inches of water is run, and on top of this the oil. Any impurities settle to the bottom of the water, and are left when the oil is drawn off. In some of the larger refineries these bleachers literally cover acres of ground. The great objection to this method of bleaching is the length of time occupied and the immense space taken up by the bleachers.

It may be asked, What is the object of deblooming oils? So far as I can learn the only object is that they may be used to adulterate the more expensive animal and vegetable oils, such as lard, tallow, linseed, and cottonseed oils.

A mixture of lard oil, 75 per cent at 50 cents a gallon, and debloomed neutral oil, 25 per cent at 13 cents a gallon, will pass for pure lard-oil with anyone but an expert. This fraud may be detected by the lower flashing and burning points of the mixture and by the change in specific gravity from that of pure lard oil. The tests mentioned above may also be applied.

D. T. MARSHALL.

Boston, Mass., April 21.

ASTRONOMICAL NOTES.

[*Edited by George A. Hill.*]

Winnecke's Periodic Comet.

IN No. 3,083 of the *Astronomische Nachrichten* Dr. Haerdtl of Vienna publishes corrected elements for Winnecke's periodic comet, and also an ephemeris extending into next September. The comet will reach perihelion on July 1, be the nearest to the earth on July 9, when it will be only 11 million miles from the earth and attain a brightness 140 times that it had when found by Dr. Spetalerou March 18 last. The comet at the date of discovery was 72 million miles from the earth. The epoch of the ephemeris is for Berlin midnight.

	R.A.			Dec.		
	h	m	s		°	′
April 30	11	34	23	+	44	2
May 1		32	42		44	8
2		31	4		44	13
3		29	27		44	18
4		27	52		44	22
5		26	20		44	26
6		24	49		44	29
7		23	11		44	31
8		21	52		44	33
9		20	27		44	34
10		19	3		44	35
11		17	41		44	36
12		16	21		44	36
13		15	3		44	35
14		13	46		44	34
15		12	13		44	33
16	11	11	16	+	44	31

Comet Swift.

The following is a continuation of the ephemeris for comet Swift. This comet may prove to be a very interesting one, as the computations made seem to point to the fact that it is moving in a hyperbolic orbit. The observations at the present time do not extend over a sufficient interval to be absolutely sure of this statement, but as the comet is a bright one, it will probably give us a long series, when the question can be definitely settled. We have so few positive cases of comets moving in hyperbolic orbits that this one will receive at the hands of computers a very thorough discussion. The Rev. G. M. Searle, director of the Observatory of the Catholic University at Washington, has computed both hyperbolic and parabolic orbits for this comet. The difference between computation and observation for the middle places in the hyperbolic orbit is zero, while in the parabolic orbit it is + 15″ in longitude and + 7″ in latitude. The following is a continuation of the ephemeris published in No. 481 of *Science*.

	R.A.			Dec.		
	h	m	s		°	′
May 8	22	53	10	+	25	28
9		55	58		26	6
10	22	58	45		26	42
11	23	1	30		27	18
12		4	13		27	53
13		6	55		28	28
14		9	35		29	2
15		12	14		29	35
16		14	51		30	7
17		17	27		30	39
18	23	20	1	+	31	11

Comet Denning.

The following is an ephemeris for comet Denning. The epoch is for Berlin midnight:

	B.A.			Dec.		
	h	m	s		°	′
May 8	3	11	48	+	55	11
9		15	23		54	57
10		18	54		54	42
11		22	22		54	27
12		25	46		54	12
13		29	7		53	57
14		32	24		53	42
15		35	38		53	27
16		38	48		53	12
17		41	55		52	57
18	3	44	58	+	52	41

MR. PETRIE'S DISCOVERIES AT TEL-EL-AMARNA.

ONLY recently the news reached us of the discovery by the Direction of Exploration in Egypt of the tomb of King Amenhotep IV. (Khu-n-aten) at Tel-el-Amarna; and now, from another quarter, we hear of further important discoveries in the same locality.

The labors of Mr. W. M. Flinders Petrie, who has been working all winter at the excavation of the royal palace of Khu-n-aten, have been rewarded by a most unexpected find, one, indeed, that is unparalleled in the history of archæology. Lying on the ground, tossed in a corner among spoilt blocks of rough granite "Ushabtis," discarded by the artisans who had prepared the king's sepulchral furniture, lay the plaster cast, the mask, of the dead man himself, evidently taken immediately after his death by the sculptors employed to carve his statues. It is in an almost perfect state of preservation.

This extraordinary relic of one of the most interesting figures of antiquity lends unforseen support to the view of the monarch's character suggested in my last article. According to Mr. Petrie, the face thus revealed, as it were, in the flesh, "is full of character. There is no trace of passion in it, but a philosophical calm, with great obstinacy and im-

practicability. He was no fanatic, but rather a high-bred theorist and reformer" How vividly clear do such facts as these make the remote past appear; and what deep meaning they lend to the words of that greatest of word-painters, Ernest Renan: "A giant even placed on the confines of a picture still remains a giant."

The palace has been exhumed and the pavements — beautifully frescoed with tanks and fishes, birds and lotus plants, and almost unique in their style — have come to light; also inlaid walls and splendid columns inscribed with scenes and capped wilh capitals imitating "gigantic jewelry." Their surface was encrusted with brilliant glazes, and the ridges between these were gilt, so that they resembled gems set in gold, the effect thus produced reminding the explorers of the "net-work" of the "Temple of Solomon."

Mr. Petrie was also fortunate enough to come across smaller objects, which have thrown light upon the history of the period. In a neighboring quarry he found the name of Queen Thii, the mother of Khu-n-aten, unaccompanied by that of a king. This fact has given him good ground for the suggestion that she may have governed alone during the minority of her son, who, to all appearances, was only married in the fifth year of his reign, his first child having been born in his sixth year. In the fifth year of his reign the king was still called Amenhotep, as shown in a papyrus found at Gurob, but in his sixth year he appears at Tel-el-amarna as Khu-n-aten; so that the great schism which led to the final rupture between himself and the Theban priesthood must have occurred between those two dates.

Moreover, Mr. Petrie has in his possession a scarab on which Amenhotep is represented in adoration before Aten, the name of Amen having been subsequently erased. This scarab finally settles the question, so often raised, of the identity of the man who bore both names.

Relics of the successors of Khu-n-aten — Ra-Saa-Ka-Khepru, Tut-Ankh-Amen, Ai — were also recovered at Tel-el-amarna, showing them to have resided there after him; and even Hor-em-heb left a block of sculpture inscribed with his "cartouche" in the temple of Aten, probably in the early part of his reign and before his compromise with the conservative Theban party. After that time the site was apparently abandoned and no traces remain of further occupation.

The cuneiform tablets discovered in 1887 were all in storerooms outside the palace, near the house of the Babylonian scribe, which Mr. Petrie identified by finding the "waste pieces of his spoilt tablets in rubbish holes."

A large quantity of Ægean pottery similar to the Mykenæ and Ialysos type was found, of even greater variety of form than that recovered at Gurob. And this as well as the naturalistic character of the frescoes, which Mr. Petrie compares with those of Tiryns and with the gold cups of Vaphio, and the geometrical patterns that decorate some of the columns, which in his opinion closely approach the art of the Mykenæ period, are highly suggestive of Greek intercourse and influence.

The court of Khu-n-aten, in the fifteenth century B.C., must have been a remarkable one. Under the quickening influence of a great mind the foreign conquests of the warlike monarchs of the eighteenth dynasty seem to have been made to yield the richest fruits of peace. A wide-spread intercourse had been established among nations; Phœnicians, Syrians and Mesopotamians, Greeks and Mediterranean Islanders are revealed to us as having come into the Nile valley, bringing along with their commerce their arts, their industries, and various indirect influences. No wonder that the priests of Amon saw with dread and aversion the influx of foreigners who, encouraged by the evident cosmopolitanism of their king, bid fair to revolutionize the ancient traditions of their venerable land and to remove the narrow boundaries of Egyptian conservatism. S. Y. STEVENSON.

THE ROLLING OF SHIPS.[1]

ONE fact that often strikes the thoughtful traveller by sea is that, notwithstanding the great and numerous improvements of recent years which have made life on shipboard pleasant and luxurious, little or nothing has been done to steady a vessel when she meets with waves that set her rolling heavily from side to side. The tendency seems to be rather in the direction of increased than of diminished rolling; for the steadying influence of sails, which makes the motion so easy and agreeable in a sailing ship, is fast disappearing in large steamers. Masts and sails add appreciably to the resistance of large fast steamers; so they have been cut down in size year by year till such fragments of sail as still remain are so small compared with the size of the ship as to retain little power to reduce rolling.

Shipowners and seamen do not show much sympathy with the discomfort and misery that rolling causes to most passengers. They perhaps get anxious about an occasional vessel that acquires the evil reputation of being a bad roller, because passengers may be frightened away and the receipts fall off in consequence; but beyond wishing, or attempting, to deal with abnormal cases, nothing seems to be thought of. Rolling is considered incurable, or as not of sufficient importance to trouble about. Yet there is nothing which would contribute so directly to the comfort of landsmen at sea, or do so much to change what is for many misery and torture into comfort, as to check and reduce as far as possible the rolling proclivities of ships.

The laws which govern rolling are now well understood, and it is strange that this knowledge has not enabled an effective means of control to be devised. What is stranger still is that well-known means of mitigating rolling — such as the use of bilge keels — are employed in but very few cases. A ship rolls about a longitudinal axis which is approximately at her centre of gravity, and the rolling is practically isochronous at moderate angles in ordinary ships. The heaviest rolling occurs when the wave-period synchronizes with the natural period of oscillation of the ship. Many vessels are comparatively free from rolling till they meet waves of this period, and if such meeting could be avoided, excessive rolling could be prevented. Some vessels have periods as long as fifteen to eighteen seconds for the double oscillation, and as these would require to meet with waves 1,300 to 1,500 feet in length, in order to furnish the conditions of synchronism, it is seldom that they suffer from heavy or cumulative rolling. Such waves are, however, not rare in the Atlantic.

The limits of heavy rolling are fixed, of course, by the resistance offered by the water and air to the transverse rotation of the ship, which is very great because of the large areas that directly oppose motion in a transverse direction. But for this resistance, and the condition that rolling is only isochronous within moderate angles of inclination, a few waves of the same period as that of a ship would capsize her.

[1] From Nature.

The two most obvious modes of preventing heavy rolling are, therefore, (1) to make the period of rolling of a ship as long as possible, so as to reduce the chances of meeting waves whose period will synchronize with it, and (2) to increase the resistance to rolling. The period of a ship varies directly as her radius of gyration, and inversely as the square root of her metacentric height. Hence the period may be increased by increasing the moment of inertia of the ship, or by decreasing the metacentric height. In armored war-vessels the moment of inertia is large, on account of the heavy weights of armor on the sides, and the heavy guns that are either placed at the side or high up above the centre of gravity. Ordinary steamers have no such weights concentrated at great distances from the centre of gravity, and their moments of inertia are determined by the distribution of material in the hull that is fixed by structural conditions and by the stowage required for their voyages. Metacentric height cannot be reduced below a certain amount, which is necessary to prevent too easy inclination of the ship, or crankness, in still water. On the whole, we may regard the longest periods that the largest ships are likely to have with advantage to be about those named above, i.e., fifteen to eighteen seconds.

Length of period cannot give immunity against occasional heavy rolling; but increase of resistance reduces the angles of roll at all times, and especially when the angular velocity is greatest and the rolling is worst. Such resistance is furnished by the frictional resistance of the bottom of a ship and by the direct resistance of projecting parts of the bottom, such as the keel and the large flat surfaces below at the stem and stern. This resistance can be largely increased by means of bilge keels. The value of bilge keels is recognized in the Royal Navy, and the ships of the navy have been fitted with them for many years with highly beneficial results. The advantage of bilge keels was proved beyond all doubt many years ago by careful experiments made in this country and in France; and the late Mr. Wm. Froude showed, by the trials he made of H.M.S. "Greyhound" twenty years ago, that bilge keels of excessive size — 3 feet six inches deep, and 100 feet in length, on a vessel 172 feet long — had only an insignificant effect upon speed throughout great differences of trim.

It is strange that the mercantile marine should not yet have adopted bilge keels, and obtained the undoubted advantage they give in steadiness. The number of ships that have them is comparatively few. There is an almost universal opinion and prejudice against their use, and the largest and finest passenger steamers have no bilge keels. This is in spite of the fact that, in cases where bilge keels have been fitted to try to check heavy rolling — and they have been of suitable size and properly placed — it has been found that the angles of rolling have been reduced by nearly one-half. There is a prevalent belief — which has no foundation in fact — that bilge keels are very detrimental to speed. We have said that Mr. Froude's experiments showed the contrary, even on trials made in still water; but it appears certain that at sea any trifling loss of speed which still-water trials might show would be more than compensated for by gain in speed when the vessel is prevented from rolling through large angles from side to side, and undergoing great changes of underwater form at every roll. Experience with ships that have had bilge keels added after running for some time without them shows that there has been no appreciable difference of speed or increase of coal consumption on their voyages.

Another, and a more heroic, method of stopping or reducing rolling would be to counteract the inclining moment of the ship caused by the ever-changing inclination of the waves by an equal and opposite moment, which would vary as the inclining moment varies. This has been attempted at different times and in various ways. It is essential to any degree of success, however, that the opposing moment brought into operation should be completely under control, so as always to act in the manner and to the extent required. The attempts to obtain a steady platform by freely suspending it, and making it independent of the rolling of the ship, have failed — apart from the practical difficulties of carrying out such an arrangement on a large scale — because the point of suspension oscillates when the ship rolls, and the platform acquires a rolling motion of its own. Weights, made of heavy solid material, which move from one side to the other of a ship subject to the action of gravity and rotation, fail because they cannot be made to act continuously in the manner required.

A degree of success has been achieved by admitting water into a suitably prepared chamber and leaving it free to move from side to side as the ship rolls. This has been done in several ships of the navy, the case of the "Inflexible" being that which was the most carefully experimented upon. The movement of this internal water follows the inclination of the ship, but it lags behind, and thus tends to reduce the inclination. Its effect can be regulated by the quantity of water admitted into the chamber and by its depth. The "Inflexible" committee state in their report that comparatively small changes in depth increase or diminish largely the extinctive power of the water. For various reasons — one of which is that while such a chamber is very effective in a moderate sea it fails in a rough sea when the rolling of the ship is greatest — and perhaps partly on account of the destructive and disturbing effect of 100 tons or more of water rushing from side to side of a ship over sixty feet wide — these water-chambers appear to have gone out of use in the navy, and they have been given up in the "City of New York" and "City of Paris," which vessels were said to be fitted with them when first built and placed upon the Atlantic.

Mr. Thornycroft has devised a means of checking rolling by moving a weight, under strict control, from side to side of a vessel so as to continuously balance, or subtract from, the heeling moment of the wave-slope. It consists of a large mass of iron in the form of a quadrant of a circle, which is placed horizontally, with the centre on the middle line of the vessel, and there connected with a vertical shaft. The shaft is turned by an hydraulic engine, which is very ingeniously controlled by an automatic arrangement. The heavy iron quadrant is swept round from side to side, revolving about its centre, to the extent that is required to counteract the heeling moment. In a paper read on the 6th instant before the Institution of Naval Architects, Mr. Thornycroft said: —

"The manner in which the controlling gear works will be better understood if we imagine a vessel remaining upright among waves, while near the centre of gravity of the ship we place a short-period pendulum suspended so as to move with little friction; this will follow the change in the apparent direction of gravity without appreciable loss of time, so that any change in the wave-angle and apparent direction of gravity cannot take place without due warning, which will indicate the time and amount of the disturbance. It is therefore only necessary to make the motion of the

ballast bear some particular and constant ratio to the motion of this short-period pendulum to keep the balance true. The inertia of a heavy mass will cause some loss of time, as we can only use a limited force for its control; but it is possible to accelerate the phase of motion and overcome this difficulty so far as to get good results.

"If, now, we imagine the ship to roll in still water, the effect of the combination just described will be to balance the ship's stability for a limited angle; but this defect is removed by the introduction of a second pendulum of long period, which tends to move the ballast in the opposite direction to the first one, and enables the apparatus to discriminate between the angular motion of the water and that of the vessel.

"I find, however, that the long-period pendulum is rather a delicate instrument, and that its function can be served by a cataract arranged so as to always slowly return the ballast to the centre, and this device has the effect of accelerating the phase of motion, which, in some cases, we also require.

"We are therefore able, by very simple parts, to construct an apparatus which will indicate the direction and amount of motion necessary to be given to the ballast at a particular time so as to resist the wave effort; this power of indicating may be converted into one of controlling by suitable mechanism. The loss of time due to inertia of the necessary ballast is not always unfavorable when the apparatus has to extinguish rolling motion, the greatest effect being obtained when the ballast crosses the centre line of the ship at a time when it is most inclined to the water surface, and this corresponds to a quarter of the phase behind the motion of the short pendulum."

The apparatus has been working for some time in the steam yacht "Cecile" with very good results. What the objections may be to applying it to the largest passenger steamers remains to be seen. A moving weight of something like 100 or 150 tons would probably be required in such vessels. The power necessary to control the movement of the weight appears to be small, and Mr. Thornycroft's invention seems at any rate to show the way towards obtaining the long-desired boon of substantially reducing, if not checking altogether, the rolling of ships. If it succeed in doing upon a large scale only a portion of what is claimed for it in the way of anticipating and counteracting the heeling effect of waves, without the possibility of acting in an erratic or undesirable way, we may hope to see it adopted some day in passenger steamers.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

A Fire-Ball.

A TELEPHONE wire was supported on cedar posts 20 feet high and 20 rods apart. During last August [1889] we had a thunder-storm, during which there was a sharp and heavy crash. Several of the poles were found to have been struck, and portions to have been taken out through their entire length. One of these portions, of the size of a medium rail, was thrown into an adjoining field some rods from the pole. Portions from the others were smaller and more or less shattered. Near the southernmost pole struck, a family were in a house with doors and windows open, and a luminous ball seemed to leap from the wire, pass through the open door and a window, and pursue its course some rods through the open space behind the house. A boy in the room grasped his thumb and cried out, "I'm struck," and Mr. Hewett felt a sensation of numbness in his left arm for some time. A girl seized her shawl and rushed out of the house to chase the ball. She reported that she pursued it some distance, while it bounded lightly along, until it seemed to be dissipated in the air without an explosion. The size of the ball was about that of the two fists, and its velocity about that of a ball thrown by the hand.

C. C. BAYLEY.

Lightning.

THE account of a stroke of lightning in *Science* for Jan. 29 last and the article in the issue of April 8 on "The New Method of Protecting Buildings from Lightning" call attention to a subject which has been greatly neglected, viz., the nature, characteristics, and effects of lightning strokes. Besides the passage of the electricity from the cloud to the earth, or the reverse, heavy discharges are always accompanied by other phenomena, which vary on different occasions, and which, for want of record and tabulation, have not yet been explained and their laws determined. In the loose accounts given of them in our daily journals they are spoken of as "freaks of lightning," and no further notice is taken of them. In the hope of doing something towards making a careful record, I offer the following, which has never been published.

The village of Amherst, Mass., is supplied with water from a reservoir among the Pelham hills, about five miles distant. The aqueduct runs nearly in a straight line from east to west. The pipes are made of thick sheet-iron bent into tubes, and the overlapping edges are riveted together with copper rivets about two inches apart. They are covered both without and within with a thick coat of cement. The joints are filled with cement so that the irons do not come in contact, an iron ring five or six inches broad is slipped over the joint, and the whole covered with cement. At a place about half a mile west of the reservoir the aqueduct runs near the foot of a steep hill that is seventy or eighty feet high and covered with a recent growth of white pine, shrub oaks, and yellow birch from ten to thirty feet in height, the intervals of the trees being filled with bushes. During a very heavy shower in July, 1884, a thunder-bolt was seen to fall on the hill. It struck a pine tree half-way down the side of the hill, whose top, on a horizontal line, was not more than two rods from the bottom of the trees on the summit. The tree struck was about twenty-five feet high and eight inches in diameter at the butt. The lightning did not apparently strike it on the top, but about one-fourth of its height from the top, at three equidistant points on the circumference the bark began to be ruptured, and the ruptures continued in straight lines to the ground. There the three currents united, ran over the ground, scattering the dirt and leaves in all directions for two rods, until it came over the aqueduct. There it bored a hole an inch in diameter down to the pipes. It struck about the middle of one of the lengths, broke the cement, and indented the iron as with a heavy blow of a sledge-hammer. The surface of the indentation appeared to have been melted. The current then turned to the west, ran along the top of the pipes, which were full of water under heavy pressure, stripped off the cement and slit the iron tubes through the whole, or a part, of their length. When a line of rivets came in its path, it cut them off between the overlapping edges of the iron as smoothly as with a knife, leaving the parts in each edge undisturbed. At the joints it rent off rings and cement, and indented the edge facing the current, melting the surface as in the place where it first struck the pipe. Rarely was the edge from which the current flowed indented. These effects continued for more than a mile, growing less and less, and finally disappeared.

Several questions in this connection require solution.

1. If the discharge is simply the equalizing of the potential between the cloud and the earth, why was that not accomplished as

soon as the current reached the ground, the wet earth being a good conductor?

2. Why did not the lightning strike the trees on the summit rather than one several feet below, and why not the top of the latter?

3. Why did it indent the pipes, and why the edges facing the current rather than the other? Is electricity material? Can anything not material manifest such a *vis viva* or working energy? Why was the iron melted when electricity has no inherent heat?

4. Do not the effects at the junctions of the pipes indicate a sort of damming up of the current by the cement until the pressure became sufficient to burst the barrier, and then it struck the following edge with its accumulated flood?

MARSHALL HENSHAW.

Amherst, Mass., Apr. 21.

[The phenomena presented in lightning strokes have heretofore appeared so lawless that it may be well to call attention to the fact, which has been repeatedly observed, that but little damage is generally done to portions of trees on the same levels as the foliage. It has also been observed that the presence on any level of a conductor of considerable surface, and consequent large electrical capacity, mitigates the effects on that level. Whether the large conducting surface presented by the wet leaves of a tree is a parallel case is, of course, a question; but the fact as stated is among those well authenticated in regard to lightning effects.—Ed.]

Periodicity of the Aurora.

ON Saturday night, April 23, there was a fine Aurora seen in this locality whenever the clouds broke away until after midnight. This display is specially interesting because it is the sixth consecutive return of an aurora at the precise interval of twenty-seven days, the dates being as follows: Dec. 9, Jan. 5, Feb. 2, Feb. 29, March 27, and April 23. The display will be due again upon May 20. It has been associated with reappearances at the sun's eastern limb of an area south of the equator which has been much frequented by spots and faculæ. In like manner a record now before me shows that reappearances at the eastern limb of disturbed areas in the sun's northern hemisphere have their chief magnetic effect during the autumn months. From this it would seem that in order that a solar disturbance may affect the earth's magnetism it must be in a particular location, namely, at the eastern limb and as near as possible to the plane of the earth's orbit. Certainly such disturbances do not have their magnetic effect promiscuously in all locations, or at present we should have auroras and magnetic storms continuously, which is very far from being the case.

M. A. VEEDER.

Lyons, N.Y., April 25.

CALENDAR OF SOCIETIES.

Philosophical Society, Washington.

April 28.—G. M. Searle, On a Simple Form of Double-Image Micrometer; Arthur Keith, The Geology of Chilhowee Mountain in Tennessee; B. E. Fernow, Timber Physics.

Chemical Society, Washington.

April 14.—Wm. H. Krug, On Behavior of Acetone and Carbo-Hydrates; F. W. Clarke, On the Decomposition of Certain Silicates by Heat; Thomas Taylor, Smokeless Powder.

Publications Received at Editor's Office.

BRYANT, WILLIAM C. Sella, Thanatopsis and other Poems. Boston, Houghton, Mifflin & Co. 16°, paper. 95 p. 15 cts.

GORE, J. HOWARD. A German Science Reader. Boston, D. C. Heath & Co. 12°. 196 p. 80 cts.

MILLER, OLIVE THORNE. Little Brothers of the Air. Boston, Houghton, Mifflin & Co. 12°. 271 p. $1.25.

POSSE, Nils. Handbook of School Gymnastics of the Swedish System. Boston, Lee & Shepard. 18°. 192 p. 50 cts.

WEED, CLARENCE M. Spraying Crops. New York, Rural Pub. Co. 16°. 110 p. Ill.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

For sale or exchange, Das Ausland, 10 vols., 1882 to 1891, including 6 vols. bound, 4 in numbers. Wheeler Survey, vol. 1, Geog. Report; also vol. 6, Botany; Production of gold and silver in the United States, 1880, '1, '2, '3, '5; Selfridge Isthmus of Darien. Will sell at very low prices. J. F. James, 1443 Corcoran St., Washington, D. C.

For exchange.—A fine thirteen-keyed flute in leather covered case, for a photograph camera suitable for making lantern slides. Flute cost $27, and is nearly new. U. O. COX, Mankato, Minn.

To exchange; Experiment Station bulletins and reports for bulletins and reports not in my file. I will send list of what I have for exchange. P. H. ROLFS, Lake City, Florida.

Finished specimens of all colors of Vermont marble for fine fossils or crystals. Will be given only for valuable specimens because of the cost of polishing. GEO. W. PERRY, State Geologist, Rutland, Vt.

For exchange.—Three copies of "American State Papers Bearing on Sunday Legislation," 1891, $2.50, new and unused, for "The Sabbath," by Harmon Kingsbury, 1840; "The Sabbath," by A. A. Phelps, 1842; "History of the Institution of the Sabbath Day, Its Uses and Abuses," by W. L. Fisher, 1859; "Humorous Phases of the Law," by Irving Browne; or other works amounting to value of books exchanged, on the question of governmental legislation in reference to religion, personal liberty, etc. If preferred, I will sell "American State Papers," and buy other books on the subject. WILLIAM ADDISON BLAKELY, Chicago, Ill.

Wanted, in exchange for the following works, any standard works on Surgery and on Diseases of Children: Wilson's "American Ornithology," 3 vols.; Coues' "Birds of the Northwest" and "Birds of the Colorado Valley," 2 vols.; Minot's "Land and Game Birds of New England;" Samuels' "Our Northern and Eastern Birds;" all the Reports on the Birds of the Pacific R. R. Survey, bound in 2 vols., morocco; and a complete set of the Reports of the Arkansas Geological Survey. Please give editions and dates in corresponding. R. ELLSWORTH CALL, High School, Des Moines, Iowa.

To exchange Wright's "Ice Age in North America" and Le Conte's "Elements of Geology" (Copyright 1882) for "Darwinism," by A. R. Wallace. "Origin of Species," by Darwin, "Descent of Man," by Darwin, "Man's Place in Nature," Huxley, "Mental Evolution in Animals," by Romanes, "Pre-Adamites," by Winchell. No books wanted except latest editions, and books in good condition. C. S. Brown, Jr., Vanderbilt University, Nashville, Tenn.

For Sale or Exchange for books a complete private chemical laboratory outfit. Includes large Becker balance (800g. to 1-10mg.), platinum dishes and crucibles, agate motors, glass-blowing apparatus, etc. For sale in part or whole. Also complete file of *Silliman's Journal*, 1852-1885 (62-71 bound); Smithsonian Reports, 1854-1883; U. S. Coast Survey, 1854-1869. Full particulars to enquirers. F. GARDINER, JR., Pomfret, Conn.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, can have the 'Want' inserted under this head at 10 cents a count line. Nothing inserted at less than 50 cents a time prepaid by stamps, if most convenient.

TRANSLATOR wanted to read German architectural works at sight (no writing). One familiar with technical terms desired. Address "A.," Box 149, New York Post Office.

WANTED.—A position in a manufacturing establishment by a manufacturing Chemist of inventive ability. Address M. W. B, care of *Science*, 874 Broadway, N. Y.

WANTED.—Books on Anatomy and Hypnotism. Will pay cash or give similar books in exchange. Also want medical battery and photo outfit. DR. ANDERSON, 182 State street, Chicago, Ill.

WANTED.—A college graduate with some normal training, to teach the sciences, at $1,800 per year, in a Southern college. A Baptist or a Methodist preferred. Must also be a first-class Latin scholar. A. H. Beals, Box K, Milledgeville, Ga.

A PROFESSORSHIP in Chemistry is wanted by one who has had five years' experience in that capacity. Would prefer to give instruction by lectures and experiments rather than by text-book methods. Would like a position in a college or university where there is a good student's laboratory. Special points of strength claimed are: (1) Thorough control of a class and good order during lectures and recitations. (2) Accuracy in experimenting with chemicals and skill in the manipulation of chemical apparatus. The permission of several distinguished educators has been given to refer to them if required. Would not care to accept a position paying less than $1,500. Address B. E, care of *Science*, Advertising Dept., 47 Lafayette Place, New York.

ADDRESS WANTED.—Will some one please send the address of the Secretary of the American Philological Society. Also that of Herbert Spencer. "ADDISON," Room 84, 164 Madison St., Chicago, Ill.

ADDRESSES of Old Book Dealers wanted.—Wishing to obtain a number of old books out of print, I very much desire the addresses or catalogues of rare second-hand book dealers. If there is a directory or list of such dealers I should like to obtain possession of one. W. A. BLAKELY, Chicago, Ill.

WANTED.—(1) A white man versed in wood and iron working, able to work from specifications and plans, suited for an instructor of boys; his business to have charge of shops of school, outline and direct the work for foremen and students; salary to be $1,000 per annum (nine months). (2) A man (black preferred) to teach the colored, iron working and forging, subordinate to the preceding; salary, $720. (3) A man (white) competent to take classes in engineering (assistant's position), but with the ability to perform any of the work required in any of the ordinary engineering courses of our universities; salary from $1,000 to $1,500. A. H. BEALS, Milledgeville, Ga.

AMONG THE PUBLISHERS.

Babyhood continues in its May issue the medical articles on catarrhal affections and their complications in children, and the treatment of the headaches of childhood.

— The recent discussion over Jewish immigration to this country imparts a timely interest to Mr. Joseph Pennell's volume entitled "The Jew at Home." This artist has visited and studied the Jewish towns of the Austro-Hungarian Empire, and the results of his observations will be found both in his text and in a series of illustrations. "The Jew at Home" will be published immediately by D. Appleton & Co.

— *The Chautauquan* for May presents the following among other articles: "Physical Culture," IV., by J. M. Buckley, LL.D.; "The United States Patent Office," Part I., by Helen Frances Shedd; "The Natural History of Plants," II., by Gerald McCarthy; "Flower Shows in the United States," by Samuel A. Wood; "Phrenology," by Garrett P. Serviss.

— In *Lippincott's Magazine* for May, Mr. Floyd B. Wilson has a paper on "Personal Economics in our Colleges," and Mr. Philemon Hemsley, in "After-Dinner Botany," traces the relationship between certain edible and other plants not usually connected in our thoughts.

— Professor Jowett's translation of "The Dialogues of Plato," the second edition of which has been for several years out of print, will appear in May in the third edition, forming five 8vo volumes. The work has been revised and corrected throughout and in great part rewritten. Macmillan & Co, the publishers, have copyrighted the new edition by resetting the entire work in this country.

SCIENCE

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SCIENCE

NEW YORK, MAY 6, 1892.

PRELIMINARY NOTE ON THE RELATIONS OF THE MOTOR MUSCLES OF THE EYES TO CERTAIN FACIAL EXPRESSIONS.

In the course of some years of close observation of the anomalies of the muscles which govern the movements of the eyes, the fact that remarkable changes often follow the modification of the conditions of these muscles led me not only to regard with greater care these facial changes, but to bring to the subject the aid of photography, by which means only these expressions could be accurately registered. Photographic portraits giving a direct front-view of more than two thousand persons have thus been made. In each case a record, as full and as accurate as I have been able to obtain, of the state of these eye muscles has been made, and in the majority of the cases careful observations have been repeated many times during some weeks or months.

We have thus, for the first time, a series of observations in which the facial expressions are registered by photography, while painstaking determinations of the ocular-muscle conditions are faithfully recorded.

Beyond this, in a great number of instances, photographs have been taken at various stages of modification of these muscles, thus affording a comparative study of the face under varying conditions of the eye muscles.

The result of this study has been to demonstrate that certain well-defined types of facial expression are not only associated with but are dependent upon certain relative tensions of the oculo-motor muscles.

An elementary knowledge of the conditions of these muscles, as commonly presenting themselves in practice, is necessary to an understanding of what follows.

In an ideal condition of the eye muscles, they should, when the minimum of effort of all the opposing forces is exercised, so adjust the eyes that the lines of vision will be practically parallel. More exactly, the adjustments should be such that the visual lines would meet only at a point situated at a very considerable distance in front of the eyes.

This condition of perfect equilibrium of all the opposing eye-muscles does not always exist. Indeed, such a condition is the exception. (In this statement no reference to the conditions known as strabismus or squint is intended; in fact, in this connection all such exaggerated anomalies are left absolutely out of consideration, the purpose being to consider only the conditions in which single vision with the two eyes is maintained).

The condition of equilibrium above described is known as *orthophoria.*

In case of a normal excess of tension on the part of the muscles which rotate the eyes inward, the visual lines, should no restraining force be brought into action, would drift toward each other and visual confusion would result. In that case, by means of a voluntary but unconscious effort on the part of the opposing muscles, the lines of vision might be properly adjusted. This condition, in which there is a normal tendency of the visual lines to approach, but in which there is ability to restrain that tendency, is known as *esophoria.*

The opposite condition, in which the normal tension of the muscles which rotate the eyes outward predominates and which, if unrestrained, would cause the visual lines to diverge, is known as *exophoria,*

Another condition, in which a tendency of one of the visual lines to rise above its fellow is found, is known as *hyperphoria.*

Compound conditions called *hyperesophoria* and *hyperexophoria* are also found. The terms suggest the elements of these conditions.

In the great majority of persons, some one of these so-called anomalies is to be found. While the condition of absolute orthophoria is, perhaps, not to be expected, that of a near approach to it is sometimes, although exceptionally, found.

The conditions of esophoria and of exophoria are much more common. Hyperphoria would appear to be somewhat less common than the last two.

With each of these conditions of relative tensions of the eye muscles is commonly associated a type of expression

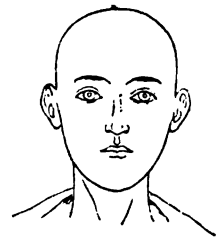

FIG. 1.

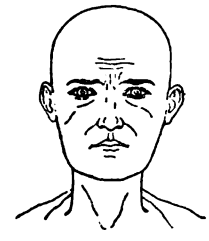

FIG. 2.

sometimes slightly but often extremely well marked. That there are found apparent exceptions to this rule, as to most other rules, is true. Yet the law is so generally prevalent as to enable us to classify nearly all faces by its assistance.

The great elasticity of muscles, together with the peculiar characteristics of the sub-dermal tissues in childhood and early youth, and the loose and wrinkled character of the skin in advanced age, to a greater or less degree disguise the characteristic expressions arising from these various muscular tensions. The types are therefore most conspicuous in early adult and in middle age.

In the accompanying diagrams, I have endeavored to illustrate the peculiarities of four principal types of facial expression as governed by the eye muscles.

With the state of equilibrium of these muscles, orthophoria (Fig. 1), the expression is one of greater repose than with any of the other states of the eye muscles. The eyebrows, which constitute one of the most striking of all the facial features, form each a moderate and regular curve, marking the border of the orbit, the lower border of the brow corresponding to the orbital border. The inner extremity descends towards the nose, but does not turn downward into the depression bounded by the nose and the orbit. There is

no sharp turn or sudden increase of curve at either extremity. The mouth is nearly horizontal or curving very slightly upwards at the centre. The lips in repose are firm but not compressed, and the upper one is well proportioned. The chin is rounded, neither square nor pointedly oval. The lines of the forehead are not usually conspicuous. The naso-labial lines curve outward beyond the angles of the mouth, less horizontally than with esophoria, and less vertically than with exophoria. The curved line below the lower lid is nearly in exact conformity with the curve made by the fold of the upper eye-lid when it is moderately raised.

The absence of special tensions of the facial muscles, in this well-balanced face, permits a quick and easy play of the features, and the habitual absence of any forcible regulation of the eyes or of the face is conducive to a mental equilibrium and to physical endurance.

With esophoria (see Fig. 2) the brows are compressed, often flattened. The extremities often curve suddenly downwards, the inner extremity sinking into the depression bounded by the nose and orbital border. The eyelids are, in a considerable proportion of cases, not as fully opened as in orthophoria, and much less separated than in the typical cases of exophoria. Two rather strong vertical lines making each an angle with the inner extremity of a brow extend upward nearly parallel, upon the forehead, as shown in the

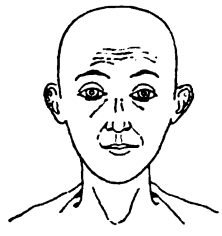

FIG 3.

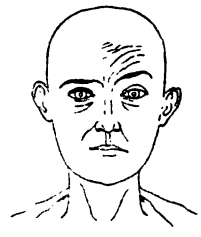

FIG. 4.

diagram. The upper lip is usually short, and the curve of the centre of the mouth upward is often pronounced. The lips are firmly compressed in repose, but in young persons with deficient physical force, the lips may be habitually open. The chin is broad and the naso-labial lines make a wider excursion outward than in orthophoria. The expression in moderate esophoria suggests firmness of character and resolute purpose.

With exophoria (see Fig. 3) the brows are usually strongly arched, often drawn upward upon the forehead, the inner extremity being often removed above and away from the nose. The lines running upward from the side of the nose, when present, are likely to diverge as they ascend. The transverse lines of the forehead are often conspicuous and are higher on the forehead than those which occur with esophoria. The upper lip is long, the centre of the mouth curves downward and the chin is pointedly oval. The facial lines are more vertical than with either of the conditions described, giving to the face the suggestion of length. The lips are not compressed and are liable to be loose and slightly open.

The expression of exophoria suggests more of idealism than of determinate purpose.

Hyperphoria is characterized by irregular features (Fig. 4). The tendency of one visual line to rise above the other demands a restraining effort in which the facial muscles often take an important part. On the side, the visual line of which tends to rise above the other, the brow is depressed, while the brow of the side whose visual line tends downward is elevated. Thus the brow and neighboring tissues of one side aid in depressing the front of the eye, while, on the other hand, by the elevation of the opposite brow less demand is made upon the muscle which is required to rotate its eye upward.

These contrary actions demanded by the relations of the visual lines in hyperphoria affect the whole face, resulting in a want of harmony of the two sides. The angle of the mouth, on the side on which the brow is depressed, is drawn upward, while the other angle is depressed. Thus one side of the face is longer than the other. On one side, the lines of esophoria are found, and on the other, those of exophoria.

In the sketch here given no attempt has been made to describe all the various gradations between these types nor to explain the exceptions. It has been the purpose of this communication only to present the general characteristics of some of the most typical forms of expression which have their origin in the efforts to adjust the eyes.

GEORGE T. STEVENS, M.D.
New York.

THE ARCHITECTURAL EXHIBITION IN BROOKLYN.

THERE is no question but that we stand upon the verge of a great popular revival of interest in architecture. Architectural books and magazines command wide circulations and numerous purchasers. Vast sums of money are yearly expended in building—call it architecture if you will. Exhibitions of architectural drawings have become regular features of winter life in the larger cities. On all hands greater interest is being manifested in the art than ten or twenty years ago seemed possible.

To Brooklyn belongs the credit of having supported the only popular organization for the study of architecture in the country. Professional and student bodies perform a very different function than that which naturally belongs to an institution resting upon non-professional and popular bases. The Brooklyn Institute of Arts and Sciences, especially under the direction of its present efficient head, Prof. Franklin W. Hooper, has achieved a national reputation. An organization that maintains forty-five distinct courses of public lectures, numbering on an average 400 annually, must be reckoned among the most powerful intellectual forces in the country, a power which is not limited by the fact that it confines its operations to the city of Brooklyn.

It is quite in keeping with the progressive policy of the Institute that it should provide the citizens of its native city with an exhibition of architectural drawings, which is noteworthy not only as an evidence of progress on the Institute's part, but as being the most ambitious attempt of the kind yet made in Brooklyn. First attempts are always liable to leave something to be desired, but the Brooklyn Exhibition, which has just closed, was so good on the whole that little fault may be found with it. On the contrary the gentlemen having the matter in charge are to be thoroughly congratulated on succeeding so well. Whatever faults may be found with the exhibition are faults inherent in all architectural exhibitions as a class, and are by no means limited to Brooklyn alone.

And this chief fault is the matter of the exhibition. There is no important subject on which such erroneous views prevail as on architecture. This is a fact that requires no argument. It follows as a natural consequence, therefore, that every time the architects attempt to initiate the public

into the mysteries of their art that all possible misunderstandings be avoided; certainly that they themselves make no effort to mislead those they would instruct. Yet an architectural exhibition that consists only of exteriors not only fails in giving the public a true insight into what architecture really is, but is actually, though not intentionally, a deliberate deception. Every architect knows that the designing of the facade is not the only thing he has to do in designing a building; why, then, should he not let the public know what he does and how he does it, and make his exhibitions practical schools in practical architecture, instead of simply exhibitions of facades, or pretty or ugly things — for such is the way of architecture — as the case might be.

When many older bodies fail in this respect, and keep on failing year after year, it is not to be expected that the Brooklyn Institute should make a beginning by inaugurating this much needed reform. As architectural exhibitions go the first attempt was a very good one, but it is well to keep in mind that it was not, really, an architectural exhibition, but an exhibition of facades. While this is perfectly true it contained, for its size, rather more detail drawings of a certain kind than have many more ambitious undertakings. There are several plans for the Protestant Episcopal Cathedral in New York with sections and other details, and a group of detailed drawings in the competition for the Brooklyn Savings Bank are especially attractive for the full manner in which they illustrate their subject. The greater the proportion of such drawings in our architectural exhibitions, the greater their success, and the more will the people realize the true nature and uses of architecture.

In the introduction to the catalogue the Brooklyn Institute lays down a wise programme, "occasional gatherings of the best results and suggestions." The programme is wise enough, and right enough, but unfortunately it is one of those things that can never be carried out. It depends, of course, upon the meaning attached to the word "best." If it is used in the sense of good, it is an unwise limitation, since an architectural exhibition that would consist only of the best of good buildings would be extremely limited. If it is used in the sense of the best that modern work affords it is simply repeating what would evidently follow from an exhibition arranged by architects. Unfortunately, no architectural exhibition can consist only of the best buildings; there is so much that cannot be classed as such that a too rigid scrutiny would deprive such a collection of many important examples of the newest work. Unfortunately, too, it is also true that the importance of an enterprise is no criterion for the excellence of its architecture. New York has seen many noteworthy structures erected which were disgraces both to the architects and those financially responsible for them. Even the Brooklyn exhibition contained drawings of large undertakings which all lovers of a higher architecture must regret to see carried into execution.

Some things necessarily hamper exhibition committees. The public naturally expect to see drawings of great buildings in first-class architectural exhibitions, and it is for the public the exhibitions are held and from it their support should come, if it does not. It is simply one of the architectural conditions that cannot be ignored and that will lower the standards of our architecture and our architectural exhibitions until a broader and more discriminating taste is manifested in the people generally. Then indeed will architectural exhibitions be a success and a pleasure, a source of instruction and delight, a record of past progress, and an inspiration to newer conquests.

BARR FERREE.

CURRENT NOTES ON ANTHROPOLOGY. — V.

[Edited by D. G. Brinton, M.D., LL.D.]

Criminal Anthropology.

ONE of the most actively cultivated and also one of the most immediately practical branches of anthropology is that which occupies itself with criminals.

It may conveniently be presented as consisting of three departments, one of observation, the second of explanation, and the third of application. The first takes note of the anatomical and physiological peculiarities of criminals, their psychology, the diseases to which they are most liable, their nationality and ancestry, their nutrition, the environment in which they have lived, etc. The second undertakes the more difficult task of explaining these peculiarities, relying principally on the laws of heredity, atavism, congenital tendencies, early impressions and pathological sequelæ. The third, basing itself on the inferences thus drawn, aims to suggest such modifications in penal laws, and in the management of reform schools and houses of detention as will minimize the objectionable results indicated.

Anthropologists believe that this is the only method of procedure to deal intelligently with the great and growing problem of criminality. On ascertained facts of this nature, philanthropists and legislators must hereafter base their efforts, if they would attain the best results. To those who would like to pursue the subject, two works may be recommended, both published in Paris last year — Dr. X. Francotte, "L'Anthropologie Criminelle," and Dr. Lombroso, "L'Anthropologie Criminelle et ses Recents Progrès," while Dr. Thomas Wilson of the Smithsonian Institution has recently issued an excellent review and summary of the subject.

The Origin of the Alphabet.

We may well excuse Plato for crediting the legend that the letters of the alphabet were disclosed to man by the gods themselves. Certain it is that down till to-day we have reached no positive data as to their origin. It appears that the old notion that the Phœnicians discovered them must be abandoned. Dr. Eduard Glaser, whose long and arduous researches into the epigraphy of Southern Arabia promise to throw an unexpected light on a large tract of ancient history, expresses himself (in *Das Ausland*, December, 1891) quite positively that it is in Arabia we must search for the beginnings of this marvellous invention, and probably in Southern Arabia. There, perhaps nearly three thousand years B.C., the ancestors of the Minæans and Sabeans appear to have developed several related phonetic alphabets, from some one of which the so-called Phœnician was descended. Dr. Glaser has obtained copies of some of these as yet undeciphered inscriptions, probably more than four thousand years old.

What seems sure is, that though the early Egyptian hieroglyphic writing may have suggested the alphabet, the Egyptians themselves never developed it. What is more remarkable, and it seems to me has not received sufficient attention, is the gradual degeneration of the early Egyptian phonetic hieroglyphic system into one mainly ideographic and symbolic in the late demotic writing. The signs in the latter have often no more relation to sound than have the symbols of Chinese script. Thus, three points between two vertical lines, | . . . |, means, in the demotic, "man;" but it was in no way understood to represent the sounds which were in the word, *roemt*, man, in the spoken dialect.

This degeneracy gradually arose from changes in the phonology of the tongue, while the hieroglyphic signs were

continued unchanged. It is of course nothing new to Egyptologists; but to the ethnographer and the historian of the arts it is a noteworthy instance of retrogression in one of the most useful and highly prized inventions ever made by man, and that in a country of continuous and unbroken culture.

The Native Written Language of Easter Island.

In the last published report of the United States National Museum, Washington, is a very interesting description of a visit to Easter Island in 1886 by Paymaster W. J. Thomson of the ship Mohican, U.S.N. He describes the platforms, stone images, arts, and language of the natives, aiding the reader by numerous photogravures. In these points his report is full, but not especially new. Where he does go ahead of all previous voyagers is in his information about the remarkable written language which it has long been known the natives of this island had invented, and in which they were accustomed to record their legends. The inscriptions were usually upon slabs or paddles of toromiro wood, a tree indigenous to the island. The figures are of equal height and extend in regular lines along the sides and edges of the piece of wood.

With great difficulty, and finally only by recalling the ancient adage, *in vino veritas*, did Mr. Thomson succeed in persuading an old islander to read some of the inscriptions. He is able, therefore, to show us five of them, the originals in photogravure, with translations into the native tongue of the islanders, and this text rendered into English. It is a most praiseworthy piece of ethnographic study, and should put an end to the nonsense which has long periodically appeared about this island and its inhabitants.

The figures are shown to be "pictorial symbols, carrying their signification in the image they represent." Many objects are treated conventionally, and all are depicted about the same size, thus imparting the aspect of linear uniformity. The subjects treated are family histories, traditions, and lists of the gods, the figures merely serving as pictorial reminders of the names and facts.

In all these respects the inscriptions are in no wise different and not a whit superior to those found on the "meday sticks" of the Algonquin Indians. Neither indicates a high degree of culture, and the line of their evolution is clear enough. As we might expect, the full vocabulary printed by Mr. Thomson shows the natives of the island to speak a well-marked Polynesian dialect, and they seem to have differed from the other Pelynesians in nothing but a somewhat higher developed taste for graphic and glyptic design.

The Thegiha and Klamath Languages.

Two publications have recently been issued by the Bureau of Ethnology, Washington, which should attract the attention of students of the American aborigines. Both are in the series called "Contributions to North American Ethnology."

One is entitled "The Thegiha Language," by James Owen Dorsey. The Thegiha is a member of the Siouan or Dakota stock, and is spoken by the Ponkas and Omahas. The portly volume of 794 quarto pages is filled with a large number of myths, stories, and letters in the language, accompanied by interlinear and free translations, grammatic notes and explanations. A second volume is promised containing a detailed grammar and dictionary.

The work on the Klamath language, which is nearly the same as the Modoc, is by A. S. Gatschet. It is in two quarto volumes of 711 pages each. The first contains an ethnographic sketch of the tribe especially interesting for its mythology, 200 pages of text and 500 pages of grammar; the second volume is the dictionary. The Klamath is described as a synthetic language, inclining to polysyntheticism in the inflection of nouns and the derivation of verbs. Its tendency to incorporation is well marked.

Both these laborious works are exceedingly well done, and reflect great credit on their authors. One must regret, however, that different phonetic alphabets have been adopted. Dorsey employs that of the Bureau of Ethnology, Gatschet that which he calls "my scientific alphabet, based on the original pronunciation of the letters;" not always very scientific, as may be judged from the fact that he gives as identical the *u* sound in English *nude*, German *uhr*, French *cour*. Mr. Gatschet must have learned his English where they call dukes "dooks."

THE GROWTH OF CHILDREN.

IN his recent paper on the growth of children in the Twenty-Second Annual Report of the State Board of Health of Massachusetts, page 479 ff, Dr. H. P. Bowditch has called attention to the fact that the curves representing the distribution of cases in those years during which growth continues is asymmetrical, so that the average and median values, (the one corresponding to the point above and below which one-half the total number of cases are found) do not coincide. An examination of the original tables on which this statement is based (The Growth of Children, Eighth Annual Report of the State Board of Health of Massachusetts, 1877, Table 4 *ff.*), brings out the asymmetry of the curves represented by these figures very clearly, and proves that the difference between the average and median values is not accidental. Dr. Bowditch calls also attention to the fact that the variability of the series first increases and later on decreases.

The causes of these phenomena will be considered in the following lines. When considering statures and weights of adults of a certain region, we find them generally arranged symmetrically around the average which has the maximum frequency. The tables showing the values of these measurements from year to year prove that growth is irregular, being more rapid in the beginning and becoming slower as the adult stage is nearly reached. When we consider children of a certain age, we may say that they will not all be in the same state of development. Some will have reached a point just corresponding to their age, while others will be a little backward, and others still a little in advance of their age. Consequently the values of their measurements will not exactly correspond to those of their age. We may assume that the difference between their stage of development and that belonging to their exact age is due to accidental causes, so that just as many will be less developed as farther developed than the average child of a particular age. Or: there will be as many children on a stage of development corresponding to that of their age plus a certain length of time as corresponding to that of their age minus a certain length of time.

The number of children who have a certain amount of deviation may be assumed to be arranged in a probability curve, so that the average of all the children will be exactly on the stage of development belonging to their age.

At a period when the rate of growth is decreasing rapidly, those children whose growth is retarded will be farther remote from the value belonging to their age than those whose growth is accelerated. As the numbers above and below the average are equal, those with retarded growth will have a greater influence upon the average than those whose growth is accelerated, therefore the average value of the measurement of all the children of a certain age will be too low when the rate of growth is decreasing, and too high when it is increasing.

These considerations may be expressed in mathematical form as follows: —

In the adult, the relative frequency of the deviation x from the

average value of the measurement, s, may be expressed by the formula —

$$\mathcal{P}_{s+x} = \frac{1}{\mu_1 \sqrt{2\pi}} e^{-\frac{x^2}{2\mu_1^2}}$$

μ_1 is the measure of variability of the series and is called the mean variation, or the mean variability. A series is the more variable the larger μ_1.

The value of the measurement belonging to the average of all those individuals who will finally reach the value s is, at any given period, a function of this period and may be called ${}^{s}t$. The average of all those individuals who will finally reach the stature $s + x$ may be expressed as a function of ${}^{s}t$ and x, $f({}^{s}t\ ; x)$.

The individuals constituting the adult series will not develop quite regularly, but some will be in advance of others. We assume that at any given time these variations in period will be distributed according to the law of probabilities. The relative frequency of the variation y from the period under consideration, t, will be

$$\mathcal{P}_{t+y} = \frac{1}{\mu_2 \sqrt{2\pi}} e^{-\frac{y^2}{2\mu_2^2}}$$

The value of the measurement belonging to a child which will finally reach the value $s + x$, at the period $t + y$, will be $f({}^{s}t + y\ ; x)$. $\mathcal{P}_{t+y}$ expresses therefore also the relative frequency of the individuals measuring $f({}^{s}t + y\ ; x)$ at the period t among that class which will finally reach the value $s + x$. The relative frequency of the latter among all individuals is $\mathcal{P}_{s+x}$. Therefore, the relative frequency of the value $f({}^{s}t + y\ ; x)$ among the whole series will be

$$P_{f({}^{s}t+y\ ;\ x)} = \mathcal{P}_{s+x}\,\mathcal{P}_{t+y} = \frac{1}{\mu\,\mu_1\,2\pi} e^{-\frac{x^2}{2\mu_1^2} - \frac{y^2}{2\mu_2^2}}$$

It remains to determine $f({}^{s}t + y\ ; x)$. The function $f({}^{s}t\ ; x)$ may be obtained by observations on the same individuals taken in annual intervals. The form of the function will be

$$\left.\begin{aligned} f({}^{s}t\ ; x) &= {}^{s}t + f_1({}^{s}t)\,x + f_2({}^{s}t)\,x^2 + \dots \\ \text{and} \\ f({}^{s+y}t\ ; x) &= {}^{s}t + y + f_1({}^{s+y}t)\,x + f_2({}^{s+y}t)\,x^2 + \dots \end{aligned}\right\} x_0 < x < x_1$$

By means of observations we find also

$$\left.\begin{aligned} {}^{s}t + y &= {}^{s}t + a_1 y + a_2 y^2 + \dots \\ f_n({}^{s}t + y) &= {}^{(n)}b_0 + {}^{(n)}b_1 y + {}^{(n)}b_2 y^2 + \dots \end{aligned}\right\} y_0 < y < y_1$$

By substitution we find

$$\left.\begin{aligned} f({}^{s}t + y\ ; x) = {}^{s}t &+ a_1 y + a_2 y^2 + \dots \\ &+ x(b_0' + b_1' y + b_2' y^2 + \dots) \\ &+ x^2(b_0'' + b_1'' y + b_2'' y^2 + \dots) \end{aligned}\right\} \begin{matrix} x_0 < x < x_1 \\ y_0 < y < y_1 \end{matrix}$$

For a certain series of combinations of x and y this function will remain constant. Then the function may be considered a new variable u —

$$f({}^{s}t + y\ ; x) = {}^{s}t + u.$$

The probability of finding the value ${}^{s}t + u$ is

$$T_{{}^{s}t+u} = \int_{-lim}^{+lim} P f({}^{s}t + y\ ; x)\, dy\, dx + R$$

where the limits depend upon x_0, x_1, y_0, and y_1, and where R is a certain rest which is determined by the same values.

By assuming the limits x_0, x_1, y_0, y_1 sufficiently narrow and neglecting terms of higher degrees, which may be done on account of the smallness of their factors, the equation assumes the form

$$T_{{}^{s}t+u} = \frac{(1 + c\,u)}{M\sqrt{2\pi}} e^{-\frac{u^2}{2M^2}}$$

$$M = \sqrt{a_1^2 \mu_2^2 + b_0^2 \mu_1^2}$$

This function is asymmetrical. It is, therefore, shown that the asymmetry of the curves is an effect of the irregularity of growth.

Only for $a_2, a_3, \dots = 0$

and ${}^{(n)}b_1, {}^{(n)}b_2 \dots = 0$, the curve will be an ordinary probability curve, c being zero in that case. When $a_2, a_3, \dots$ are zero, growth is regular.

We may also draw certain conclusions in regard to the value M. μ_2 is the variability of period. According to the laws of probability this variability must be proportional to the square-root of time elapsed —

$$\mu_2 = \mu \sqrt{t}.$$

It is also probable that

$$f({}^{s}t\ ; x) = {}^{s}t + x\sqrt{\frac{{}^{s}t}{s}}$$

$$b_0 = \sqrt{\frac{{}^{s}t}{s}}$$

$$M^2 = a_1^2 \mu^2 t + \frac{{}^{s}t}{t}\mu_1^2$$

We will investigate for which points

$$M > \mu_1,$$

$$a_1^2 \mu^2 t + \frac{{}^{s}t}{s}\mu_1^2 > \mu_1^2$$

$$a_1^2 \mu^2 t > \frac{s - {}^{s}t}{s}\mu_1^2$$

For small values of t, $\frac{s - {}^{s}t}{s}$ is large, but at a certain period, when a_1 is still large the product on the left-hand side will rapidly increase over that on the right-hand side until a_1 begins to decrease. It may be expected that in all cases when a_1 is sufficiently large, i.e., the growth rapid, there must be a time when the variability of the growing series is greater than that of the adult series.

M and μ_1 are known by observation. Therefore μ_2 may be computed according to the formula

$$M^2 = a_1^2 \mu_2^2 + b_0^2 \mu_1^2,$$

and we have, therefore, a means of determining the variability of period of the growing individuals. By means of this value we can also determine how many individuals of any given age will have reached the adult stage.

This theory holds good for statistics of all kinds of development, whatever the cause of the development may be: for physical measurements as well as for psychical; for growth as well as for the effects of practice.

FRANZ BOAS.

Clark University, Worcester, Mass., April 25.

G. P. PUTNAM'S SONS will publish immediately "New Chapters in Greek History," based upon the latest archæological discoveries, by Professor Percy Gardner of Oxford, and "The Test Pronouncer," by W. H. P. Phyfe, a companion to the author's "7,000 Words Often Mispronounced," containing the same list of words, differently arranged, for convenience in recitations. They also announce new supplies of Phyfe's books on pronunciation: "7,000 Words Often Mispronounced," "How Should I Pronounce," and "The School Pronouncer."

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AN INSTRUMENT FOR MAPPING HOT AND COLD SPOTS ON THE SKIN.

Preliminary Note.

VARIOUS defects and inconveniences in the apparatus employed by Blix, Goldscheider and Donaldson led to the determination to produce an instrument that would present a metal point of any desired temperature at any point of the skin. The temperature must be accurately known and must not vary. A registering apparatus was also to be provided, and the old system of testing till a spot was found and then marking it with ink was to be done away with.

In the present instrument the hot or cold stimulus is applied by water running through a small copper box that comes to a point at one end. The constant stream of water keeps the point at the temperature desired, and a thermometer projecting from the top of the box indicates this temperature. To prevent sudden changes resulting from the application to the skin, the sides of the box are rather thick, thus providing a mass of copper of great conductivity; a change of temperature at any one point is at once compensated by conduction without any measurable effect on that of the whole box.

To apply this box to the skin, an arm has been constructed which can be placed in any position and which by means of rack and pinion gives a motion to the box in the three planes of space. The arm is supported by a ball-joint so arranged that it can be clamped anywhere to a table or a chair in a manner that will bring the point of the litttle box near the skin-surface to be examined. Finer adjustments are made by the screws of the rack and pinion. The point is now applied to the skin, and is moved forward by one of the screws for a short distance, e.g., one centimeter, the person noticing the temperature spots as the point passes over them. Then the point is moved sideways one millimeter, and drawn back again. In this way the whole surface can be gone over with the greatest accuracy.

On the part of the arm moving with the point is a small electro-magnet carrying a pencil which descends when the circuit is completed. On the part that does not move with the point is a litttle flat plate, on which a piece of millimeter paper is fastened. The circuit is closed by a key in the hand of the person experimented upon whenever he feels a hot spot or a cold spot, as the case may be. Since the pencil executes the same motion as the point the result is an accurate map of the spots directly on the millimeter paper,

E. W. SCRIPTURE, PH.D. (Leipzig).
Clark University, Worcester, Mass.

SOME USES OF BACTERIA.[1]

EVERY farmer, of course, appreciates the value of keeping stock, and you all know that you cannot run a farm without your cows, your horses, your sheep, your hens, and your pigs. You do not appreciate, however, that it is just as necessary to keep a stock of bacteria on hand, on your farm, to carry on your farming operations. The farmer has learned to-day that he must keep a good breed of cows and a good breed of stock in general, but farmers generally do not appreciate that it is equally necessary to keep a good breed of bacteria. You cannot make butter or cheese without cows; you cannot make butter or cheese satisfactorily without bacteria. You cannot cultivate your fields without your horses to help you, but all the cultivation that you might give your fields would be useless were it not that these little creatures of which I shall speak this morning come in after you get through and complete the process which you have begun.

Now, probably many of you have never particularly thought that your farm is stocked with bacteria, but they are there. They are in your brooks, in your springs, in your wells, in your rivers; they are in your dairy, in your milk, in your butter, in your cheese, in your barn. They are in the air, they are in the soil, and your manure heap is a paradise for them.

Bacteria are in rather bad odor in the minds of most people, and we are all inclined to look with horror upon them. We have a sort of shrinking when any one speaks to us of the number of bacteria in the milk which we drink. The reason for this, however, is simply an historical one. When bacteria were first discovered it was early noticed that they had a causal relation to disease, and scientists went to work from the very first to investigate diseases in relation to bacteria. The result was that after a few years a great deal of information had accumulated showing that bacteria caused diseases. The so-called "epidemics" are usually the result of bacteria, and with minds intent upon this side of the question scientists did not pay much attention to the good that bacteria might do in the world. It was more interesting to study disease. People are very much interested when you begin to tell them why it is that they have small-pox, why it is that they have yellow-fever; the other side of the matter, however, is not so interesting.

But the fact is that the bacteria story has only been half told, and thus far it is the smaller half that has been told, if there is such a thing as the smaller half. It is true that bacteria are occasionally injurious to us, but it is equally true that they are of direct benefit to us. Hitherto we have looked upon bacteria as belonging to the medical profession; we think the doctors ought to know about them because they produce disease, but ordinary people do not need to bother themselves with these things. But I think, before I get through with my talk this morning, you will see that bacteria have a very much closer relation to you as farmers than they do to the doctors. It is the farmer to-day who ought to understand bacteriology. It is well enough for the medical man to understand the subject also, but bacteriology has already become a medical subject, while the agriculturist has generally neglected it.

I propose in my talk this morning to point out to you a few of the benefits which you as farmers derive from the agency of these microscopic organisms. I shall divide the subject into four

[1] An address by Dr. H. W. Conn, Wesleyan University, Middletown, Conn.

heads. First, *miscellaneous:* At the very outset I am going to say a word or two in regard to yeasts. Now, yeasts are not bacteria, but they are microscopic plants closely related to bacteria, and their agency in nature is very similar to that of bacteria in some respects; so I shall say a word or two in regard to them.

What is the function of yeasts? Yeasts are plants which have the power of growing in sugar solutions, and while growing there they break the sugar to pieces and produce from it two compounds; one of them is alcohol, and the other one is the gas which we commonly call carbonic acid (CO_2). We make use of yeasts for various purposes along two directions. We may use them either for the purpose of getting the alcohol or for the purpose of getting the carbonic acid. For instance, you want to bake a loaf of bread; you take your dough, you plant yeast in it and set it in a warm place; now, there is always a little sugar in the dough, and the yeast begins to grow, breaking the sugar to pieces as I have just stated, and producing from it alcohol and carbonic acid. The carbonic acid is a gas, and as the yeast grows and the carbonic acid makes its appearance in the bread, little bubbles are seen in the dough until presently it becomes filled with these little bubbles of carbonic acid gas which render it lighter. Of course, as the gas accumulates the dough swells, or, as we say, it "rises." Then you bake it, and when you take it out of the oven and cut it open you find that the bread is full of little holes. Those little holes are the remains of the bubbles of carbonic acid gas which the yeasts produced, and the object of growing the yeast was simply to make those holes in the bread. The bread is light, and the object of the introduction of the yeast is thus accomplished. You cannot bake a loaf of bread, then, without the agency of microscopic organisms.

In the baking of bread we have an instance of the use of carbonic acid alone. In the manufacture of wine the object of the vintner is to get the other product of yeasts, namely, the alcohol. He grows yeasts in his grape juice, usually depending upon those from the air. Again there is carbonic acid and alcohol produced and the carbonic acid in this case passes off into the air during the fermentation, while the alcohol remains behind; when the fermentation has continued long enough a considerable amount of alcohol remains in the grape juice, and thus produces the wine. Similarly in the manufacture of alcohol or of any of the other alcoholic liquors, such as rum or whisky, the same process is made use of; that is, the little yeasts are planted in some sort of sugar solution, it may be molasses, it may be barley; they grow there; there they produce carbonic acid and alcohol; the carbonic acid is allowed to go off into the air, and the alcohol remains behind. Then by the processes of distillation the alcohol is separated from the fermenting mass. The carbonic acid is all given off into the air in these cases.

In the manufacture of beer the attempt is made to get both products of the yeast growth. In the making of beer the yeast is cultivated in the same way in the malt; alcohol and carbonic acid both are produced. After some fermentation the beer is put into bottles. A certain amount of fermentation takes place after the bottling. The carbonic acid thus produced is dissolved in the liquid and soon accumulates so as to produce considerable pressure. When the bottle is opened it is this gas which causes the froth at the top of the beer. It is the alcohol which produces the intoxicating quality in the beer, but it is the carbonic acid chiefly which gives the beer its sharp, pungent taste. The alcohol aids, of course, to a certain extent, but the carbonic acid is the chief factor in the taste of beer. It may be a little question whether it is proper to use yeasts in this way, to produce rum, whisky, alcohol and beer, with the untold miseries which they involve; nevertheless, yeasts are at the foundation of the gigantic industries connected with distilling and brewing operations.

The farmer makes use of them in the manufacture of cider. Yeast from the atmosphere is planted in his apple juice; it attacks the sugar that it finds there, breaks the sugar to pieces, and produces carbonic acid and alcohol as before. The carbonic acid accumulates during the first day or two, and gives the sharp, pungent taste that is noticeable in sweet cider. Later on the alcohol accumulates in larger quantities, and that gives the taste to hard, sour cider. After the cider has fermented for several days the carbonic acid is of second importance; the alcohol accumulates until you get the strong, sharp, intoxicating hard cider. So much, then, for the uses to which we put yeasts.

Now, leaving yeasts, turn for a moment to the consideration of a few miscellaneous phenomena connected with bacteria. I may take as a starting point this very product that I mentioned last, namely, hard cider. Your yeasts produce alcohol in your cider. You let your cider stand in a barrel for several months, and little by little a change takes place in it; little by little the oxygen is taken out of the air and handed over to the alcohol, and when the alcohol gets hold of the oxygen it is no longer alcohol; it becomes acetic acid, and your cider is changed into vinegar. Now, it has been determined that it is through the agency of bacteria that the alcohol succeeds in getting hold of the oxygen. Bacteria grow on the surface of hard cider, forming a sort of scum, producing indeed, what we call "mother of vinegar." These bacteria growing on the surface in some way take oxygen out of the air, pass it down into the fluid, give it to the alcohol, and when the alcohol gets hold of it, it becomes acetic acid, and you get vinegar where you originally had cider. The manufacture of vinegar, then, is a process dependent upon the growth of bacteria.

The manufacture of lactic acid is a process somewhat of the same character. Lactic acid is not a commercial article of very great importance, but still there are some factories in this country that manufacture it and put it upon the market to be sold for certain purposes. In the making of lactic acid the manufacturer makes constant use of bacteria. By the cultivation of bacteria in milk the milk sugar is changed into lactic acid, which the manufacturer separates from the milk and puts upon the market. So you see that the manufacturer of lactic acid is wholly dependent upon bacteria; he could never produce it without their aid.

Perhaps, under this head of "Miscellaneous," I may just refer to a matter which is of considerable practical importance, and that is the matter of ensilage. We do not know very much about the theory in regard to the management of a silo at the present time, but we do know that the whole process of procuring proper and sweet ensilage is a process of properly managing bacteria growth. If you manage the bacteria growth correctly your ensilage will remain sweet and will become a food which is very desirable for your cattle; but if you do not manage the bacteria growth correctly your ensilage will decay, it will become sour, undergo fermentations, and you will suffer from it. It is, then, to bacteria that the farmer owes his new process of obtaining food through a silo.

I will pass now to the consideration of the second topic, and that is, the relation of bacteria to dairy matters. I have already once or twice before in your meetings brought up this question of the relation of bacteria to the dairy. At the meeting a year ago some of you may remember that we considered the subject of the fermentations of milk, when we saw that all of these fermentations, most of which are very undesirable, are connected with the growth of micro-organisms. Now, so far as milk is concerned, bacteria are pretty much of a nuisance. The milkman does not want them; they produce the souring of his milk; they make his milk bitter or slimy; sometimes they make it blue, and they produce all sorts of abnormal fermentations which a milkman does not want. But I am not to consider that side of the question this morning, and I will pass the subject of milk and turn for a moment to a consideration of the relation of bacteria to butter-making and cheese-making.

Every butter-maker is acquainted with the fact that in the normal process of making butter, the cream is collected from the milk and then is allowed to ripen. It is put in some sort of vessel and allowed to stand in a warm place for a day or so, and during that time immense changes are taking place in it. At the end of the time the cream has become slightly soured, it has acquired a rather peculiar, pleasant, indescribable odor, and it has reached the proper condition for churning. During that time, our microscope tells us that bacteria have been multiplying with absolutely inconceivable rapidity. They multiply so that they increase during a day, perhaps, five to six thousand-fold. Each bacterium with which you start when you begin to ripen your cream, produces at least

six thousand by the end of twenty-four hours, and usually they will produce a much larger number than that. So that bacteria are growing in this ripening cream with absolutely incredible rapidity. Now, you butter-makers know that you gain some advantage from ripening the cream, or, at least, you think you do. You think your butter churns a little easier and that you get a little more butter from a given quantity of cream if you ripen it, and, above all (and this, perhaps, may be regarded as the chief value of ripening), the butter acquires that peculiar, delicate, pleasant aroma which is essential to a first-class quality of butter, that peculiar aroma which is not acquired if you do not properly ripen your cream before churning it.

Now, the explanation of the production of that aroma is simply this: These bacteria are agents of decomposition. Bacteria, as they grow in any solution, tend to decompose it or pull it to pieces. If they grow in an egg, they decompose the egg and cause it to putrefy and decay, and when they begin to grow in your cream they begin the same process of decomposition. If you should let your cream ripen for a week or two, you would very readily see that the process of decomposition had taken place, and your cream would become very offensive. The moment you begin to ripen your cream, the bacteria begin to decompose it. Now, as the result of decomposition, a great many chemical products are produced, and they have all sorts of smells and tastes. If you should let decomposition go far enough, you would get the bad odor of decay, but you do not get that odor when decomposition begins. The first of the decomposition products are rather pleasant in odor, and pleasant in taste, and if you churn your cream at that stage of decomposition, your butter is flavored with the early decomposition products. This flavor is the aroma of good butter, this is what fancy butter-makers sell in the market and get a high price for. They get a high price, then, for the decomposition products of bacteria, for a proper tasting butter brings a higher price than that which does not have this aroma, and the aroma is the gift of bacteria. You may ask, What becomes of the bacteria? It really makes little difference what becomes of them. Some go into the buttermilk, some go off in water used in washing, some go into the butter and the salt kills them. It is no matter where they go. After the butter is churned they are no longer of any importance to you or any one else; their career, so far as the dairy is concerned, is ended.

If the butter-maker owes something to bacteria, the cheese-maker owes everything to them. The butter-maker cannot get the proper aroma without the agency of bacteria, but the cheese-maker cannot get anything. Of course you all know that fresh cheese is very inane and tasteless. Nobody likes fresh cheese. It has a sort of curdy taste and is quite unpalatable. You know, however, that after cheese is made, it is set aside for a number of weeks to ripen. It may ripen several weeks, or, perhaps, months. Sometimes in the case of the best cheeses, it may be ripened a year or more. Now, during that ripening process, exactly the same changes are taking place that I have mentioned in cream. The bacteria are growing, are attacking the casein, and pulling it to pieces. They produce many changes in it, and cause an accumulation of all sorts of materials which have peculiar tastes, and little by little the cheese is ripened. After a while the cheese begins to have a pleasant taste and then a strong taste, and if you leave it long enough, you get a very strong cheese. The longer you ripen a cheese, the stronger its taste becomes. An old cheese is always a strong cheese, a fresh cheese is always a mild cheese. The shorter the time you cultivate bacteria in it, of course the slighter will be the changes which they produce; the longer you cultivate the bacteria, the stronger becomes the cheese.

Now; in the ripening of cheese, we find the cheese manufacturer's greatest difficulty. Every cheese manufacturer knows that, under conditions which seem to be exactly alike, he may get good cheese and he may get bad cheese. His cheese may become tainted, it may become spotted with little red spots or some other abnormal conditions may appear which he cannot account for. It would be the greatest boon possible to the cheese-maker if we could, in some way, enable him to correct his abnormal ripening processes, and be able always positively to insure the proper sort of ripening. Now, this is plainly a matter which is connected with the planting of the proper kind of bacteria in a cheese and planting them under proper conditions. Different kinds of cheeses are on our markets. We have the Edam cheese, we have the pineapple cheese, we have the Neufchatel cheese, we have the Limburger cheese, and many other kinds. Of course, we all know that these different cheeses have very different flavors. Now, in the production of these different kinds of cheeses, there are different methods used. For instance, in the manufacture of Edam cheese, the cheese-maker puts a little slimy milk into the milk that he is going to make into his cheese. That slimy milk contains a certain species of bacteria, and that peculiar species connected with that slimy milk produces the peculiar flavor which we get in the Edam cheese. Sometimes cheese is allowed to ripen soft for a few days before it is pressed, and when thus ripened, different kinds of bacteria grow in it, and grow in it more rapidly and produce different odors. Experiments have just been begun along this direction which show that it is possible artificially to ripen cheese abnormally. You can take certain species of bacteria and grow them in cheese, and you get a very atrociously tasting cheese, and you can take others and get a very good cheese. Now, in the use of yeasts, we have learned to plant yeast in our bread; we have learned to plant yeasts in our material that we want to ferment, if we are going to make alcohol, or, if we are going to make beer. The brewer has learned that he must use an artificially prepared yeast. He has learned that if he simply allows the malt to ferment naturally through the agency of atmosphere yeasts, he does not know what he will get. It will ferment, undoubtedly, but it will be likely to ferment in an abnormal manner. He, therefore, plants a pure culture of the proper yeasts. But we have not yet learned to plant bacteria in the same way. The cheese-maker has not yet learned to cultivate bacteria as the brewer has learned to cultivate his yeasts. Some day, I think we may say in the not far distant future, after our Experiment Stations have had time to work upon this matter a little longer, the cheese-maker is going to be told of some way in which he can cultivate bacteria as the brewer does his yeast, and then he will know what kinds of bacteria will produce a badly-ripened cheese, and what kinds will produce an exceedingly good cheese. The time is coming, it has not come yet, but when it does come, we can see that there will be a tremendous development of the cheese industry in this country.

We know there are four or five hundred species of bacteria in the world. They all produce different sorts of decomposition, they all produce different odors and different flavors, and when our scientific stations have taught our cheese-makers to cultivate their bacteria and plant particular kinds of bacteria in the milk of which they are going to make cheese, perhaps we are going to have four or five hundred different kinds of cheese. For aught we can see, it may be that the various species of bacteria will produce different flavored cheeses, and perhaps fifty years from now, perhaps in less time, a man may go to the store and order a particular kind of cheese that was made by a peculiar kind of bacteria, and another one made by another kind. We cannot tell what possible development there may be of the cheese industry in the future, and whereas now the cheese-maker must depend very largely upon accident for the particular kind of flavor he is going to get in his product, then he will be able to tell absolutely what he must use in order to be able to produce the flavor that he wants. The result will be a great development of the cheese industry, if such time ever comes.

There will be another advantage in this development when it comes. We all know that once in a while cheese becomes poison. Everyone has read in the newspapers accounts of people who have been poisoned by eating cheese. Under certain conditions, cheese is very distinctly poisonous, and has produced very many cases of sickness and many cases of death. Now, our chemists have studied this poisonous cheese. They have found that it is poisonous because of the production of a peculiar chemical substance in it which they have called "tyrotoxicon." They have found, further, that this tyrotoxicon is a poison produced by a certain species of bacteria. Once in a while that poisonous kind of bacteria gets into milk. The cheese manufacturer is entirely innocent; he cannot help it, because he has no means of knowing

anything about it. But occasionally they get in and his cheese is ripened then under the agency of these injurious bacteria. The result is, that his cheese becomes poisonous, and while he is perfectly innocent of any intentional wrong, the evil is done. Now, when our cheese-makers have learned to apply to the manufacture of cheese the processes which our brewers have learned in the manufacture of beer, these troubles can be prevented. Twenty years ago, a Frenchman, Pasteur, undertook to make an investigation of the diseases of beer, and he found that they could be prevented by the use of a few simple remedies which prevented the growth of the wrong kinds of yeasts or the wrong kinds of bacteria in it. His methods were soon applied to the whole brewery industry in France, and also to the manufacture of wine, and the result has been that those diseases which used to be so common and so troublesome to the vintners and the brewers have practically disappeared. So, then, when we in the future learn to apply similar methods in the manufacture of cheese, we may hope for the disappearance of all diseases of cheese, including the red specks in cheese, tainted cheeses of all sorts, and also the disease which makes cheese poisonous, as just mentioned.

You see, then, that to the dairy interests bacteria are of distinct value. They give the aroma to your butter, and they give the whole flavor to your cheese, or at least, the chief flavor. Without them your butter would not command so good a price in the market; without them your cheese would not command any price.

I may now pass to the third branch of my subject and speak of the use of bacteria as scavengers in the world. A tree in the forest falls to the ground and it lies unmolested. It is at first hard, solid, and impervious to all of the normal agencies. No insects can touch it; they cannot bite the hard wood to any extent. It lies there month after month. Little by little it begins to soften.

First the bark begins to get soft and finally falls off. By-and-by the wood gets quite soft, so that you can easily cut it, and perhaps run a pointed stick into it. Then insects can get hold of it, and they begin to eat it; they bore tunnels and begin to crawl through it. The tree grows softer and softer, and finally, as you all know from observation many times, the trunk of this tree becomes softened into a mass of brown powder which sinks down into the soil and disappears. What has become of that tree? A bird dies and falls on to the ground, and unless some animal comes along to eat the bird, you will notice that the tissues of the bird very soon begin to undergo changes; they begin to soften; gases rise from them; the flesh of the bird undergoes the process which we call putrefaction, and that putrefaction results in the gradual decomposition of the tissues. Little by little part of the material passes off into the air as gas, and the rest of it sinks down into the soil, and the bird disappears. What has produced all of these changes? Did it ever occur to you to ask what the condition of the surface of the earth would be at the present time if it were not for these processes which we call the processes of decay? Suppose there were no agencies which caused the gradual softening and destruction of trees and the dead bodies of animals. Long since the vegetable and animal life of this world would have disappeared, and we should have had the surface of the earth covered with the accumulations of the growth of forests in past ages that would have tumbled upon each other until there would be such an accumulation of dead trees and dead leaves and dead vegetation of all kinds on the surface of the earth, that plants would not be able to grow. The dead bodies of all the animals that have lived in the past would have been piled up until the whole surface of the world would have been so covered by the dead bodies of animals and plants that life would have become impossible. These scavengers, these bacteria, are absolutely necessary to us. It is through the agency of certain bacterial organisms that the tree is softened so that insects can get at it. It is through the agency of bacteria that the tissues of the bird are decomposed and gases produced which pass off into the air. It is these bacteria which cause all the changes in the bodies of animals and vegetables, decomposing them until they gradually sink down into the soil and disappear. So it is through their agency and this alone, that the surface of the earth is kept in a condition which renders it possible for life to continue to exist. Of course you have all had experience of the value of bacteria as scavengers in removing bad odors. We speak of scavengers as of value in removing decaying material, but it is the bacteria which produce the decay, and it is through their agency that all of these dead bodies are broken to pieces and brought into a condition in which they can be either incorporated into the soil, or passed off into the air.

Perhaps I may here also say a word in regard to the agency of bacteria as scavengers in the human body. We look upon bacteria in our bodies as causes of disease rather than things which are of any value, and yet a healthy person always has bacteria in large quantities in his mouth, in his stomach, and in his intestines. The bacteria are always migrating in the body to places of abnormal growths, and there is considerable reason for thinking that to a certain extent these bacteria act as scavengers in the human body. Some of them unquestionably act as producers of disease, but, to a certain extent, it seems that these bacteria are of value in assisting in the decomposition of tissues that should be decomposed, and there is reason for thinking that they assist in the digestion of food. There is no question that bacteria may assist in the process of digestion and it is doubtless a fact that the bacteria which we take into our alimentary canal are not wholly injurious. They may be possibly beneficial to us either in the line of scavengers in removing material which ought not to remain in our bodies, or in assisting digestion. This point, however, is not yet demonstrated, and I merely allude to it as a possibility.

This may lead us to the fourth topic of my lecture, which I may call the Agency of Bacteria in Plant Life.

Did it ever occur to you to ask why nature is perpetual? You know animals and plants have continued to live on the surface of the earth for hundreds and hundreds of centuries. The vegetation that has been growing on the surface of the earth has been constantly taking food out of the air and taking food out of the soil, and animals have been constantly feeding upon the plants. But the process seems to be a never-ending one. It would seem that the material for plant food and animal food would sometime be used up; and yet nature is perpetual. Now, the reason that nature is perpetual is, because animals and plants are enabled, by certain processes of nature, to use the same material over and over and over again. They can use material for food, and eventually that same material gets in a condition in which they can use it for food once more. Let me take a single illustration, one that you are probably all familiar with. Plants, as the result of their life, use up carbonic acid of the air, and, in return, send off into the air an equivalent amount of oxygen. Now, animals in their life, take out of the air a considerable amount of oxygen and send off from their bodies an equivalent amount of carbonic acid. You see here one of the adjustments of nature. Animals use the excretions of plants, plants use the excretions of animals. The animals take oxygen and give off carbonic acid, and the plants take carbonic acid and give off oxygen. The process goes on continually, and thus the condition of the atmosphere, so far as oxygen and carbonic acid are concerned, is kept in the same normal state. Thus, so far as these gases are concerned, nature is enabled to be perpetual by the constant use of the same material over and over again.

Now, this is not only true in regard to oxygen and carbonic acid, but it is true also that all the other foods of animals and plants are capable of being used over and over again. Plants live upon phosphates, sulphates, and nitrates chiefly, as well as carbonic acid. Animals live upon such things as albuminoids and starches and sugars. Now, plants cannot live on the food of animals, and animals cannot live on the food of plants. You and I cannot live upon sulphates and phosphates and potassium salts and nitrates and carbonic acid. These are what we call inorganic compounds in nature. Animals cannot feed upon them, but plants can do so. The plants can take those materials and manufacture out of them the starches and sugars and fats and albuminoids, and then we can take the starches and sugars and fats and albuminoids which have thus been manufactured for us and feed upon them. You see, therefore, that the plants serve as a medium of communication between animals and nature. The world is made up chiefly of

inorganic compounds like these phosphates and sulphates and potassium salts, etc., and the plants serve as a means of communication between animals and the inorganic world, for the plants take these inorganic materials and make them into something which we can use as food. Plants, then, are the means which we have of making use of inorganic nature; or, in other words, the whole animal kingdom is parasitic upon plants. But plants are in their turn utterly unable to live upon animal foods. A plant cannot feed upon albumen, a plant cannot eat starch, a plant cannot eat sugar, a plant cannot eat fat; plants are unable to use the foods that animals use, and when the body of a plant dies, although it is in a condition to be used as food by animals, it is not in a condition to be used again as food for plants. The dead body of the bird is in a condition in which plants cannot make use of it at all. A plant cannot use the albumen of the bird's tissue; a plant cannot use the fats in an animal; a plant cannot feed upon the sugars that are in the dead sugar-canes; a plant cannot feed upon the starches or the cellulose that is in the body of the dead tree. Nevertheless, the plants do succeed in getting hold of this food, and it is through the agency of these bacteria that we are speaking of this morning that they do it. Just as soon as the body of an animal or plant dies, the bacteria get into it, begin to grow in it, decomposing it, and pulling it to pieces. They pull the starch to pieces, they pull the sugar to pieces, and albumens and fats share the same destruction. Little by little they take those compounds which plants cannot feed upon, and, by shaking them to pieces, bring them down to simple combinations which plants can feed upon.

Of special importance is one particular kind of organism known as "the nitrifying organism," which produces nitric acid. Plants, as I have said, cannot feed upon such things as albumen. The putrefying bacteria can decompose albumen and break it up into certain simple compounds, but ordinary putrefying bacteria are not able to break that albumen down far enough for plants to get hold of it. Plants have got to live upon such things as nitrates and salts of nitric acid. Now, there is one sort of bacteria living in the soil which gets hold of the albuminous compounds and forms nitric acid. This is the nitrifying organism, and the nitrification is the last stage in the decomposition process by which an albuminoid is converted into a condition in which plants can get hold of it. One practical application of this you are all familiar with in the ripening of fertilizers. You know that green manure is of absolutely or of practically no use as a fertilizer on your fields. You know that it must first stand for a while and ripen, or "rot," as you call it. Now, what is taking place in that fertilizer while it is ripening? Simply the series of changes that have been mentioned. That fertilizer contains chemical compounds of a high degree of complexity, compounds that the plants cannot feed upon; they are too highly complex for plants to use as food. Bacteria, however, get into that heap and begin to grow in it; and, as the fertilizer becomes ripened, these high chemical compounds are pulled to pieces, they become converted into simpler decomposition products, and eventually, if the ripening is continued long enough, the fertilizer is in a condition fit for the fields. Now, when put upon the fields, the plants can get hold of the material. You will see now what I meant when I stated at the beginning of my lecture that in spite of all the cultivating that you and your horses might do in the fields, it would be useless without the agency of these organisms. You might put on your fertilizer; but, if that fertilizer is not acted upon by bacteria, it will be of no use, and thus the bacteria come in to complete the operation which you began. You do your duty and the bacteria do theirs, and the consequence is, the fertilizers which you are using are brought into a condition in which the plants can get hold of them, and thus the food of plants is produced. You see, then, that in this way plants and animals are able to use over and over again the same material. The plant gets this material out of the soil and out of the air; the animal comes along then and feeds upon the plant; then the animal dies, and the plant dies, and the bacteria get into the body of the animal or plant, pull it to pieces and produce from it decomposition products, and they get into the soil in the form of nitrates and nitric acid compounds; or they go off into the air in the form of ammonia and carbonic acid. The bodies of these animals and plants are thus reduced to simple conditions, and now the plants once more get hold of them, and use as food the same material that previous generations used. Thus over and over again the same material is used, and thus nature is kept perpetual. This is the explanation of the constant, perpetual growth in nature. This is the reason that nature does not exhaust itself. This is the reason that animals and plants have been enabled to grow upon the surface of the earth for the past hundreds and hundreds of centuries.

But this is not the end of the agency of bacteria in plant life. They are not only of value in ripening your fertilizers and in keeping up this constant growth of nature, but we have learned within the last two or three years that at the very foundation the growth of plants is absolutely dependent upon these organisms, and similarly in the future the continuance of the vegetable world must be also dependent upon them. I have stated that nature is perpetual because the same material can be used over and over again. That is true in a sense, but not true completely, for you will see with a little thought that little by little the soil is being drained of its food, little by little the materials in the soil are being turned into the ocean. A tree grows, takes out of the soil its food, and finally dies. If it falls on to the ground, as I have described, the bacteria get at it and grow there until the tree eventually becomes wholly incorporated into the soil so that it can be used once more as plant food. But it may be that the tree instead of falling in the forest falls into a river, drifts down the river, begins to decay, and eventually goes into the ocean. After the products of decomposition are passed into the ocean, there is no getting them back to the soil. "The sea will not give up its dead," and the ocean does not give up the nitrogen and the other salts that are gradually being carried to it by this process. Or, again, a plant grows and produces wheat, produces fruit, produces nuts, and the grain, the fruit, and the nuts are taken to the city to be used as food for men. The food is used by men, and most of it eventually gets into the sewage of the city, is carried down to the river, and from the river it is carried into the ocean. So here again through the sewage of our cities the foods which are supplied to our cities are being thrown into the ocean, and thus the soil is being drained of its foods. This process is not a rapid one. It is only slowly that the foods are being taken out of the soil and carried to the ocean. Nevertheless, it is the constant dropping that wears away the rock, and it is easy for us to see that if this process goes on age after age, our soils are inevitably doomed to exhaustion. You know that many fields have become sterile, that many farms have been worn out, that many gardens are becoming infertile. You cannot cultivate your fields as you used to without furnishing them food. In the Old World this is quite noticeable. Although the constant draining of the soil by these agencies is a slow one, it is a sure one, and if there is no way of getting nitrogen and other salts back from the ocean to the soil, it would seem that the life of all vegetation is inevitably doomed to exhaustion, and with the life of vegetation the life of animals must cease, the whole living world must end.

When the scientist observed this fact, he immediately looked around to see if there was not a remedy for it. Now, as far as some of the plant foods are concerned, there does not seem to be any occasion for fear. The phosphates, the sulphates, and the potassium salts, which are plant foods, seem to exist on the surface of the earth in almost unlimited quantities. There have been immense amounts of these salts found in certain parts of the world, and they can be mined at very small expense; they can be taken all over the world and put directly upon the soil, so that the sulphates, phosphates, and potassium salts are in practically unlimited quantities. We have no fear so far as they are concerned. For an indefinite number of ages to come there is plenty of this sort of food on the surface of the earth for us to supply to the soil. But that is not true of the nitrogenous foods. Of course, every farmer knows to-day that nitrogenous food is one of the very essential foods of plants, and it is not true that there is an unlimited quantity of nitrogenous salts anywhere in the world. There are few sources of nitrogen other than the soil. The chief one is the guano beds in the South Pacific. These are sources of nitrogeneous compounds, and upon these sources the agricultural in-

dustry of the world has been drawing for years, and will continue to draw until they are exhausted. But these sources are far away. The nitrogen that we get from them is very expensive, and the store is very limited in quantity. We can see in the not very distant future the complete exhaustion of all these nitrogen beds. This has led scientists to look with a considerable degree of dismay upon the future of the vegetable world. What is going to happen when all the available nitrogen is used up? If we are going to continue to take the nitrogen from the soil, and throw it into the ocean, we will soon exhaust the soil, and if there is no store of nitrogen anywhere for our plants to draw upon, what are our plants going to do in the future?

Now, there is a store of nitrogen in the world which is absolutely unlimited, and that is in the air that surrounds us. The air that we breathe is made up of four parts of nitrogen and one part of oxygen. There are quantities of nitrogen everywhere if the plants could only get hold of it, but it has been thought that plants cannot feed on the nitrogen in the air at all. Experiments have been carried on for a great many years to find out whether plants could not in some way or other get hold of the nitrogen of the air. If we could only prove that our plants can get hold of the nitrogen in the air then the problem is solved. But the experiments which have been carried on year after year have seemed to demonstrate that plants cannot use the nitrogen of the air for food, that it is not in a condition in which they can get hold of it. About ten years ago, however, certain experimenters in this country and in Europe found that in some of their experiments plants did in some way get hold of nitrogen from some source when it was not fed to them; that a plant could be grown in sand absolutely free from nitrogen, and yet in some way that plant got hold of nitrogen; the only source for it was out of the air. That led to further experimentation until within the last four or five years the results have all been pointing in one direction. They seem to show us that there is one family of plants, at least, which is capable of getting hold of nitrogen out of the air. This is the plant family to which the pea, the bean, and the clover belong. It is, in general, the pea family — the *Leguminosæ* family of plants. This family of plants in some way does succeed in getting nitrogen from some source when we do not give it to them as food, and it must be that they get it from the air. And yet those experiments are entirely contradictory to the earlier experiments, which seemed to show that plants could not get hold of nitrogen in the air. The explanation was not found until a few years ago. Two or three years ago some experiments were performed in Germany which have finally led to the solution of the problem, at least in part, and, curiously enough, we find that the whole secret of the matter is connected with these organisms which I am discussing this morning. It is to bacteria that we owe this power which is possessed by plants of the pea family to get hold of nitrogen. If you plant peas in soil containing a certain species of bacteria, or at least certain species of micro-organisms, these micro-organisms crawl into the roots of the pea, and then begin to multiply inside the roots. The little roots begin to swell and there appear upon them a lot of minute nodules, which have received the name of "root tubercles." If I am not mistaken, some of those little root tubercles were shown to the meeting here last evening. These root tubercles, as I say, make their appearance, and it is found that wherever these root tubercles do make their appearance the plant gets hold of nitrogen and grows well. Where these root tubercles do not make their appearance the plants are unable to get hold of nitrogen unless it is fed to them. Now, these root tubercles are produced by bacteria, and these root tubercles are the agencies by which, in some as yet unexplained way, the pea gets nitrogen out of the air.

Thus you see that in the final analysis of the life of a plant, in the assimilation of nitrogen from the air, we are brought to the conclusion that it is the agency of these minute microscopic organisms that is the source of the assimilation of nitrogen from the air by plants. Thus we owe the growth of these plants to bacteria. How the bacteria get the nitrogen out of the air has not yet been explained.

Even before the scientists made this discovery, the farmer had made the discovery practically on his farm. You have known that you could, in some, to you inexplicable, way, rejuvenate an old worn-out soil by cultivating clover upon it, or by cultivating beans. That has been the practice of farmers for years. It has been found that in some way the cultivation of clover, instead of exhausting your soil as the cultivation of some plants does, really increases the fertility of the soil. You cultivate your clover for one season, then the next season you plow the roots into your soil, and you find the field will produce a better crop than before. This result is brought about through the agency of these organisms. The clover belongs to the family of peas, and clover is one of the plants that this particular species of bacteria that I am speaking of can attack. The bacteria in the soil get into these roots, grow in them, produce these root tubercles, and by means of these the clover gets nitrogen out of the air and stores it up in its roots. The next season you plow the roots into the soil, and then come the nitrifying bacteria which pull the roots to pieces and decompose them into the condition of nitrates, and then the next season the plant which you sow gets hold of the nitrates which came from the roots of the clover and which has been brought there through the agency of these bacteria. You see, then, that the farmer owes everything to the bacteria.

I think you will find that I am justified in the statement I made at the beginning, that the study of bacteriology to-day is even more truly a department of agriculture than of medicine. The bacteria belong to the farmer more truly, or at least as truly, as they belong to the physician.

Now, I must draw my remarks to a close. Let me, in conclusion, say that we must not think too hardly of bacteria. It is true they are the causes of evil, it is true that they produce disease, but it is also true that they do good. It is true that they are our enemies, but it is also true that they are our closest allies. It is true that without them we could not have our small-pox nor our yellow-fever, we could not have our diphtheria or our scarlet-fever, neither could we have the epidemic which is at present going over this country, nor, in fact, should we have any of our epidemics, were it not for the bacteria. But when we remember that it is through the agency of these organisms that we bake the loaf of bread that comes on to our table, that it is through their agency that the immense brewing industries are able to exist, that it is through their agency that the industries connected with the manufacture of alcoholic liquors are possible; that without them we could not get our vinegar or our lactic acid; that without them we could not make our ensilage; when we remember that these bacteria give the butter-maker the aroma of his butter; when we remember that it is the decomposition products of the bacteria that the cheese manufacturer sells in the market; when we remember their agency as scavengers, how it is that they keep the surface of the earth clean and fresh and pure and in a constant condition for the continued growth of plants; when we remember their value to the soil in decomposing the dead bodies of animals and plants, and thus enabling the same material to be used over and over again for the support of life, and hence making possible a constant, perpetual condition of nature; and when we remember, lastly, that it is only through their agency that plants were originally enabled to get hold of nitrogen at all, and that it is only through the agency of these bacteria that we may hope for a continuance of a supply of nitrogen to the soil,— when we remember all these things, I think we will recognize that the power of the bacteria for good far outweighs their power for evil. Without them we should not have our epidemics, but without them we should not exist. Without them it might be that some individuals would live a little longer, if we could live at all. It is true that bacteria, by the production of diseases once in a while, cause the premature death of an individual; once in a while they will sweep off a hundred or a thousand individuals, but it is equally true that if it were not for them, plant life and animal life would be absolutely impossible on the face of the world.

THE Grand Honorary Walker Prize of the Boston Society of Natural History, a sum of one thousand dollars, has just been presented to Professor J. D. Dana of New Haven. Previous recipients of the prize have been Dr. Joseph Leidy, Mr Alexander Agassiz, and Professor James Hall.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

The Color Question.

A FEW weeks ago (*Science*, March 25) Mr. Milton Bradley wrote to you on this subject, which unfortunately is still in an unsatisfactory state, notwithstanding the researches of Helmholtz and Maxwell. Mr. Bradley is, do doubt, quite right in treating, for the purposes of his system, all the colors of the spectrum as of equal value, but it is by no means as clear as he supposes that the three colors, red, green, and violet, are entitled to be considered primaries in preference to red, yellow, and blue, if any colors are to be thus treated. The fact that Maxwell found the cross-section of a cone of color to be approximately triangular with red, green, and violet at the three corners, proves little as to the real relation between the various colors. It is very easy by means of a prism so to condense a spectrum as that only red, green, and violet shall be visible, and my impression is that some such explanation will be found of Maxwell's supposed elementary green at least. I read with suspicion such statements as that most natural yellows and blues when analyzed by a prism show a large quantity of green in their composition, and that yellow can be produced by mingling green and violet. In the former case the green is due probably to an overlapping of the yellow and the blue, notwithstanding the belief, which is erroneous, that the yellow and blue of the prism will not produce green. Anyone on looking through a prism at different objects can easily devise a mode of causing two spectra to overlap, and thus convince himself that the blue and yellow do actually thereby give rise to green. He can, moreover, make the red and violet rays overlap, and thus form shades of purple. Such being the case, green, although sometimes in overlapping spectra observed by looking through the prism it appears to obliterate the blue, is no more entitled to be called a primary color than purple itself. For all practical purposes all the colors should be regarded as primary, the question of their actual relation being left to be settled by further investigation.

C. STANILAND WAKE.
349 North Clark Street, Chicago, Ill.

Family Types.

CAN I ask one or two questions about Mr. Williams's note in the issue of April 15? Does the mother in placental mammals tend to assimilate in respect to blood to the father? Does the result of a study for twenty-five years of one family offer more than the slightest evidence on the point in question? Does the mother frequently acquire diseases belonging to the father indirectly through the child she is carrying? Does each child in a family

CALENDAR OF SOCIETIES.

Women's Anthropological Society of America, Washington.

April 30.—Miss Annie T. Smith, Report of the Committee on the Investigation of Directive Forces in Society; Mrs. York, Medical Inspection of Schools; Miss Sickles, The Ghost Dance.

Biological Society, Washington.

April 30.—The principal paper of the evening was: The Distribution of Land, Water, and Ice on this Continent in Later Geological Periods, by Professor W. J. McGee; Communications: Erwin F. Smith, The Relation of Plants to the Soil; Charles Hallock, Where Salt-Water Fishes Hide: Results of Deep-Water Seining.

Society of Natural History, Boston.

May 4.—J. S. Kingsley, Notes on the Anatomy of Amphiuma.

Publications Received at Editor's Office.

BAUSCH, EDWARD. Manipulation of the Microscope. Rochester, Bausch and Lomb Optical Co. 16°. 128 p. Ill.

CATHCART GEORGE R. Literary Reader; A Manual of English Literature. New York, American Book Co. 12°. 560 p. $1.15.

CHAPMAN, C. H. An Elementary Course in Theory of Equations. New York, John Wiley & Sons. 12°. 98 p. $1.50.

CHURCH, IRVING P. Notes and Examples in Mechanics. New York, John Wiley & Sons. 8°. 144 p., plates. $2.

GORMAN, S. The Discoboli. Cambridge, Museum Comp. Zoöl. 4°, paper. 96 p., plates.

GREELY, A. W. Irrigation and Water Storage in the Arid Regions. Report to the Sec. of War. Washington, Government. 4°, paper. 356 p. Maps.

HURST, G. H. Silk Dyeing, Printing and Finishing. With numerous colored patterns. New York, Macmillan & Co. 16°. 134 p. $2.

LANDAUER, J. Blowpipe Analysis. Trans. by James Taylor. 2d ed. New York, Macmillan & Co. 16°. 190 p. $1.10.

MORRIS, R. ANNA. Physical Education in the Public Schools. New York, American Book Co. 8°. 192 p. $1.

Business Department.

The Providence and Stonington Steamship Company's new steel steamer New Hampshire made a record for phenomenal speed on her trial trip at Wilmington, Del., on April 21, 1892. Loaded with 600 tons dead weight, she made time over the measured mile, two minutes fifty-nine seconds, an average of over twenty miles per hour. The New Hampshire is a sister ship to the Maine, recently built at Wilmington, for the Providence and Stonington Steamship Company, which has also proven a great success, both as a fast sailer and a most comfortable and luxurious boat for passengers.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

For sale or exchange, Das Ausland, 10 vols., 1882 to 1891, including 6 vols. bound, 4 in numbers. Wheeler Survey, vol. 1, Geog. Report; also vol. 6, Botany; Production of gold and silver in the United States, 1880, '1, '2, '3, '5; Selfridge Isthmus of Darien. Will sell at very low prices. J. F. James, 1443 Corcoran St., Washington, D. C.

For exchange.—A fine thirteen-keyed flute in leather covered case, for a photograph camera suitable for making lantern slides. Flute cost $27, and is nearly new. U. O. COX, Mankato, Minn.

To exchange; Experiment Station bulletins and reports for bulletins and reports not in my file. I will send list of what I have for exchange. P. H. ROLFS, Lake City, Florida.

Finished specimens of all colors of Vermont marble for fine fossils or crystals. Will be given only for valuable specimens because of the cost of polishing. GEO. W. PERRY, State Geologist, Rutland, Vt.

For exchange.—Three copies of "American State Papers Bearing on Sunday Legislation," 1891, $2.50, new and unused, for "The Sabbath," by Harmon Kingsbury, 1840; "The Sabbath," by A. A. Phelps, 1842; "History of the Institution of the Sabbath Day, Its Uses and Abuses," by W. L. Fisher, 1859; "Humorous Phases of the Law," by Irving Browne; or other works amounting to value of books exchanged, on the question of governmental legislation in reference to religion, personal liberty, etc. If preferred, I will sell "American State Papers," and buy other books on the subject. WILLIAM ADDISON BLAKELY, Chicago, Ill.

For Sale or Exchange for books a complete private chemical laboratory outfit. Includes large Becker balance (200g. to 1-10mg.), platinum dishes and crucibles, agate motors, glass-blowing apparatus, etc. For sale in part or whole. Also complete file of *Silliman's Journal*, 1862-1885 (62-71 bound); Smithsonian Reports, 1854-1883; U. S. Coast Survey, 1854-1869. Full particulars to enquirers. F. GARDINER, JR., Pomfret, Conn.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person wishing some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person wishing information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

TRANSLATOR wanted to read German architectural works at sight (no writing). One familiar with technical terms desired. Address "A.," Box 149, New York Post Office.

WANTED.—A position in a manufacturing establishment by a manufacturing Chemist of inventive ability. Address M. W. B, care of *Science*, 874 Broadway, N. Y.

WANTED.—Books on Anatomy and Hypnotism. Will pay cash or give similar books in exchange. Also want medical battery and photo outfit. DR. ANDERSON, 182 State street, Chicago, Ill.

WANTED.—A college graduate with some normal training, to teach the sciences, at $1,800 per year, in a Southern college. A Baptist or a Methodist preferred. Must also be a first-class Latin scholar. A. H. Beals, Box K, Milledgeville, Ga.

A PROFESSORSHIP in Chemistry is wanted by one who has had five years' experience in that capacity. Would prefer to give instruction by lectures and experiments rather than by text-book methods. Would like a position in a college or university where there is a good student's laboratory. Special points of strength claimed are: (1) Thorough control of a class and good order during lectures and recitations. (2) Accuracy in experimenting with chemicals and skill in the manipulation of chemical apparatus. The permission of several distinguished educators has been given to refer to them if required. Would not care to accept a position paying less than $1,500. Address B. E., care of *Science*, 874 Broadway, New York.

ADDRESS WANTED.—Will some one please send the address of the Secretary of the American Philological Society. Also that of Herbert Spencer. "ADDISON," Room 84, 164 Madison St., Chicago, Ill.

ADDRESSES of Old Book Dealers wanted.—Wishing to obtain a number of old books out of print, I very much desire the addresses or catalogues of rare second-hand book dealers. If there is a directory or list of such dealers I should like to obtain possession of one. W. A. BLAKELY, Chicago, Ill.

find the mother more impregnated with the blood of the paternal house? And if so, does this impregnation seriously tend to make the children favor the family that gives them the name? Is the fact of parental influences — the influences here alluded to being those suggested by Mr. Williams, sympathy or antipathy for people frequently seen — thoroughly established? In a love-match is the face of the father more commonly reproduced? If there are reversions to a primitive type, what is the type — one lying on the maternal or the paternal side?

Do family portraits show a uniformity? If they do, is not the question settled? How, then, can the fact that family portraits show a uniformity — that being the point in question — be cited to prove the point in question, that family portraits do, or do not, show a uniformity?

J. C. DANA.

Denver, Col., April 27.

AMONG THE PUBLISHERS.

THOMAS WHITTAKER has just published "The Story of the Discovery of the New World," by Frederick Saunders of the Astor Library, illustrated by C. A. Bobbett.

— A. C. McClurg & Co. announce a volume entitled "Direct Legislation by the People," by Nathan Cree. The author gives a brief review of direct government from the earliest times, and of the rise and development of popular representation. He then considers the advantages of combining direct popular legislation with representative institutions, in which direction, he believes, lies emancipation from political corruption. In this connection he examines two remarkable features of the Swiss Government, viz., the *Referendum* and the *Popular Initiative*. The author's standpoint is said to be conservative.

QUERY.

Can any reader of *Science* cite a case of lightning stroke in which the dissipation of a small conductor (one-sixteenth of an inch in diameter, say,) has failed to protect between two horizontal planes passing through its upper and lower ends respectively? Plenty of cases have been found which show that when the conductor is dissipated the building is not injured to the extent explained (for many of these see volumes of Philosophical Transactions at the time when lightning was attracting the attention of the Royal Society), but not an exception is yet known, although this query has been published far and wide among electricians.

First inserted June 19. No response to date.

TO THE READERS OF SCIENCE.

PUBLISHER'S ANNOUNCEMENT.

OUR PLANS.

WITHIN the past six months the use of *Science* by scientific men and women as a medium for prompt publication and weekly discussion, has increased very materially, so that the pages are now well filled each week with original matter. As the number of those promising contributions is increasing at the rate of three or four each day, it cannot be long before *Science* at its present size will be too small for the amount of matter offered. We have under consideration therefore an enlargement of the paper by one-half, but must first learn the temper of our constituency as to an advance in price to $5.00, which was the subscription price from the start for four years, up to June 30, 1887. Further, to carry out the proposed enlargement, we shall need five hundred additional subscribers. If you are not already a subscriber, are you willing to aid in making *Science* more worthy of American scientific work by becoming one?

It goes without saying, that the demand for scientific literature is limited, when compared with that for literature which is more to the public taste, so that the receipts of most of the Scientific Journals, in this country, do not pay quite for their printing and paper, to say nothing of the other items of expense. We say this merely to emphasize the fact, that generous and prompt support must be accorded this move if it is to succeed.

Titles of Some Articles Published in *Science* since Jan. 1, 1892.

Aboriginal North American Tea.
Actinism.
Amenhotep, King, the tomb of.
Anthropology, Current Notes on.
Arsenical Poisoning from Domestic Fabrics.
Anatomy, The Teaching of, to Advanced Medical Students.
Astronomical Notes.
Botanical Laboratory, A.
Brain, A Few Characteristics of the Avian.
Celts, The Question of the.
Collection of Objects Used in Worship.
Deaf, Higher Education of the.
Diphtheria, Tox-Albumin.
Etymology of two Iroquoian Compound Stems.
Eye-Habits.
Family Traits, Persistency of.
Fishes, The Distribution of.
Fossils, Notice of New Gigantic.
Grasses, Homoptera Injurious to.
"Healing, Divine."
Hemipterous Mouth, Structure of the.
Hypnotism among the Lower Animals.
Hypnotism, Traumatic.
Indian occupation of New York.
Influenza, Latest Details Concerning the Germs of.
Infant's Movements.
Inventors and Manufacturers, the American Association of.
Iowa Academy of Sciences.
Jargon, The Chinook.
Klamath Nation, Linguistics.
Lightning, The New Method of Protecting Buildings from.
Lissajou's Curves, Simple Apparatus for the Production of.
Maize Plant, Observations on the Growth and Chemical Composition of.
Mineral Discoveries, Some Recent, in the State of Washington.
Museums, The Support of.
Patent Office Building, The.
Pocket Gopher, Attempted Extermination of.
Psychological Laboratory in the University of Toronto.
Psychological Training, The Need of.
Rain-Making.
Rivers, Evolution of the Loup, in Nebraska.
Scientific Alliance, The.
Star, The New, in Auriga.
Storage of Storm-Waters on the Great Plains.
Teaching of Science.
Tiger, A New Sabre-Toothed, from Kansas.
Timber Trees of West Virginia.
Tracheæ of Insects, Structure of.
Vein-Formation, Valuable Experiments in.
Will, a Recent Analysis of.
Wind-Storms and Trees.
Wines, The Sophisticated French.
Zoology in the Public Schools of Washington, D. C.

Some of the Contributors to *Science* Since Jan. 1, 1892.

Aaron, Eugene M., Philadelphia, Pa.
Allen, Harrison, Philadelphia, Pa.
Baldwin, J. Mark, University of Toronto, Canada.
Barnes, Charles Reid, Madison, Wis.
Baur, G., Clark University, Worcester, Mass.
Beal, W. J., Agricultural College, Mich.
Beals, A. H., Milledgeville, Ga.
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SCIENCE

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SCIENCE

NEW YORK, MAY 20, 1892.

THE GROWTH OF CHILDREN.—II.

In No. 483 of *Science* I have tried to show that measurements of children of a given age are, as a rule, not distributed symmetrically around the average, but that they are distributed asymmetrically, the curve being expressed by the formula—

$$\frac{(1+cu)}{M\sqrt{2\pi}} e^{-\frac{u^2}{2M^2}}.$$

In this expression c is a small constant, M the mean variation, and u the deviation from that measurement which belongs to the individual which will finally be an average individual in regard to the measurement under consideration and whose development corresponds exactly to that of its age. In this sense the measurement may be called that of the average individual, although it is not the average of all the measurements.

Supposing an extensive series of observations on children of a certain age to be given, the question arises, how to find that value which belongs to the average individual and how to find the mean variation. The number of observations between the limits a and b will be

$$\int_a^b \frac{(1+cu)}{M\sqrt{2\pi}} e^{-\frac{u^2}{2M^2}} du = \int_{\frac{a}{M\sqrt{2}}}^{\frac{b}{M\sqrt{2}}} \frac{1}{\sqrt{\pi}} e^{-t^2} dt - \frac{cM}{\sqrt{2\pi}}\left(e^{-\frac{b^2}{2M^2}} - e^{-\frac{a^2}{2M^2}}\right)$$

Whenever a and b remain the same multiples of M, the value of this integral depends solely on $\frac{cM}{\sqrt{2\pi}}$ and a table of the values of the integral may be computed. It is convenient to assume $a = -\infty$ and to compute the integral. Following is a brief table of the integral:—

$$\int_{-\infty}^{\frac{b}{M\sqrt{2}}} \frac{1}{\sqrt{\pi}} e^{-t^2} dt - \frac{cM}{\sqrt{2\pi}} e^{-\frac{b^2}{2M^2}}$$

$$\frac{cu}{\sqrt{2\pi}}$$

b	−0.10	−0.08	−0.06	−0.04	−0.02	0.00	+0.02	+0.04	+0.06	+0.08	+0.10
−3.0 M	0.0025	0.0023	0.0021	0.0018	0.0016	0.0014	0.0012	0.0010	0.0007	0.0005	0.0003
−2.5 M	0.0106	0.0097	0.0088	0.0080	0.0071	0.0062	0.0053	0.0044	0.0036	0.0027	0.0018
−2.0 M	0.0662	0.0635	0.0608	0.0581	0.0254	0.0227	0.0200	0.0173	0.0146	0.0119	0.0091
−1.5 M	0.0990	0.0925	0.0860	0.0795	0.0731	0.0666	0.0601	0.0537	0.0472	0.0407	0.0342
−1.0 M	0.2212	0.2091	0.1970	0.1849	0.1727	0.1606	0.1485	0.1363	0.1242	0.1121	0.1000
−0.5 M	0.3907	0.3791	0.3614	0.3438	0.3261	0.3085	0.2909	0.2732	0.2556	0.2379	0.2203
0.0 M	0.6000	0.5800	0.5600	0.5400	0.5200	0.5000	0.4800	0.4600	0.4400	0.4200	0.4000
+0.5 M	0.7797	0.7621	0.7444	0.7268	0.7091	0.6915	0.6739	0.6562	0.6386	0.6209	0.6033
+1.0 M	0.9000	0.8879	0.8758	0.8637	0.8515	0.8394	0.8273	0.8151	0.8030	0.7909	0.7788
+1.5 M	0.9658	0.9598	0.9538	0.9463	0.9399	0.9334	0.9269	0.9205	0.9140	0.9075	0.9010
+2.0 M	0.9908	0.9881	0.9854	0.9827	0.9800	0.9773	0.9746	0.9719	0.9692	0.9665	0.9637
+2.5 M	0.9982	0.9973	0.9964	0.9956	0.9947	0.9938	0.9929	0.9920	0.9912	0.9903	0.9894
+3.0 M	0.9997	0.9995	0.9993	0.9990	0.9988	0.9986	0.9984	0.9982	0.9979	0.9977	0.9975

The series of actual observations must correspond to one of these theoretical curves. We must find those values of c and M which agree most nearly with the curve of the observations. c and M may be determined from any two values of the integral. The most probable values will be those which are found by taking into consideration all the given values. This may be done in the following way: We will call the value for which $u = 0$, U; then, any observed value

$$Y = U + u.$$

The average of all observed values

$$A_1 = \int_{-\infty}^{+\infty} \frac{(U+u)(1+cu)}{M\sqrt{2\pi}} e^{-\frac{u^2}{2M^2}} du$$

$$A_1 = U + cM^2 \tag{1}$$

The average of the squares of all observed values

$$A_2 = \int_{-\infty}^{+\infty} \frac{(U+u)^2(1+cu)}{M\sqrt{2\pi}} e^{-\frac{u^2}{2M^2}} du$$

$$= U^2 + 2UcM^2 + M^2$$

$$A_2 = U^2 + 2U(A_1 - U) + M^2$$

$$A_2 = -U^2 + 2UA_1 + M^2; \text{ and} \tag{2}$$

$$U = A_1 \pm \sqrt{M^2 - (A_2 - A_1^2)}. \tag{3}$$

By substituting this value in (1) we find

$$\frac{cM}{\sqrt{2\pi}} = \frac{\mp\sqrt{M^2 - (A_2 - A_1^2)}}{M\sqrt{2\pi}} \tag{4}$$

By computing the average of the observations and of their squares, we can, therefore, find easily a series of the three values U_1, M, c, and we have to select the one which gives the most satisfactory agreement between the theoretical curve and the actual curve, i.e., the one in which the sum of the squares of the differences between the two curves are a minimum. The actual computation becomes a little simpler by substituting

$$Y = C + y \text{ where } C \text{ is equal or nearly equal } A_1.$$

The average of all y $\quad a_1 = U - C + cM^2 = 0$

The average of all y^2 $\quad a_2 = (U-C)^2 + 2(U-C)(A_1 - U) + M$

$$= (C - A_1)^2 - (U - A_1)^2 + M^2$$

$$U = A_1 \pm \sqrt{M^2 - a_2 + (C - A_1)^2}.$$

I will show the application of this method by computing the stature of 12-year-old girls, measured in Worcester, Mass., 1891. 112 observations are available.

$$A_1 = 1446.6; \quad C = 1447; \quad a_2 = 5365.$$

$$U = 1446.6 \pm \sqrt{M^2 - 5364.84}.$$

We assume various values for M, and find the corresponding values for U and $\frac{cM}{\sqrt{2\pi}}$.

M	U	$\frac{cM}{\sqrt{2\pi}}$
73.8	1455.6	− 0.049
74.0	1457.1	− 0.057
74.2	1458.5	− 0.064
74.4	1459.7	− 0.070

Then the number of cases which are required by the theory may be found from the above table, while the observed number of cases are found by computing $U - 3M$, $U - 2.5M$, etc., and

counting the number of cases below these points. By this process we find the following results: —

	$M = 73.8$.			$M = 74.$.			$M = 74.2$			$M = 74.4$.		
	Observation.	Theory.	Δ	Observation.	Theory.	Δ	Observation.	Theory.	Δ	Observation.	Theory.	Δ
$U - 3.0\,M$	0.0	0.2	− 0.2	0.0	0.2	− 0.2	0 0	0.2	− 0.2	0.0	0.2	− 0.2
$U - 2.5\,M$	0.0	0.8	− 0.8	0.0	0.9	− 0.9	0.0	0.9	− 0.9	0.(	0.9	− 0.9
$U - 2.0\,M$	0.9	2.9	− 2.0	1.8	3.0	− 1.2	1.8	3.1	− 1.3	1.8	3.2	− 1.4
$U - 1.5\,M$	6.4	8.2	− 1 8	7.3	8.5	− 1.2	8.2	8.7	− 0.5	9.0	8.9	+ 0.1
$U - 1.0\,M$	18.9	18.9	− 0.0	19.8	19.5	+ 0.3	19.8	20.0	− 0.2	19.8	20.3	− 0.5
$U - 0.5\,M$	36.7	35.2	+ 1 5	37.5	36.0	+ 1.5	40.2	36.5	+ 3.7	41.1	37.0	+ 4.1
U	59.0	53.9	+ 5.1	59.0	55.7	+ 3.3	59.0	56.4	+ 2 6	59.0	57.0	+ 2.0
$U + 0.5\,M$	76.8	72.6	+ 4.2	76.8	74.0	+ 2.8	76.8	74.8	+ 2.0	76.8	75.3	+ 1.5
$U + 1.0\,M$	84.0	86.3	− 2.3	85.0	87.3	− 2.3	85.9	87.8	− 1.9	85.9	88.2	− 2.3
$U + 1.5\,M$	92.9	94.6	− 1.7	92.9	95.1	− 2.2	92.9	95.4	− 2.5	92.9	95.6	− 2.7
$U + 2.0\,M$	99.1	98.3	+ 0.8	99 1	98.5	+ 0.6	99.1	98.6	+ 0.5	99.1	98.7	+ 0.4
$U + 2.5\,M$	99.1	99.6	− .5	99.1	99.6	− 0.5	99.1	99.7	− 0.6	99.1	99.7	− 0.6
$U + 3.0\,M$	100.0	99.9	− 0.1	100.0	99.9	+ 0.1	100.0	99.9	+ 0.1	100.0	99.9	+ 0.1
$\Sigma\,\Delta^2$			62.90			35.55			37.76			39.94

We find, therefore, the following series of values corresponding best to the series of observations: —

$$M = 74.0;\quad U = 1457.1;\quad \frac{c\,M}{\sqrt{2\,\pi}} = -0.057.$$

It is clear that this method gives the more satisfactory results the greater the number of observations. If the number of observations is small, a slight change in the value of M may change any single value so much, that the regularity of the series $\Sigma\,\Delta^2$ is so much affected that the point where this sum becomes a minimum cannot be determined very accurately, although it may be possible to find it very nearly by assuming a sufficiently long series of M on both sides of the probable value and applying graphical methods for finding the minimum. The differences between the average of all statures and the stature of the average child of a certain age is quite considerable. I have computed these values for the ages of 11, 12, and 13 years, of girls.

Girls:	11 years.	Stature, Average:	1370.0	$U = 1386.9$	$\Delta = +16.9$
"	12 "	"	"	1446.6	1457.1	+10.5
"	13 "	"	"	1494.2	1506.5	+12.3

As might have been expected, the statures during a period when the rate of growth is decreasing, are higher than the averages of all statures. This difference will continue until the adult stage is reached. It becomes also probable that the average individual does not grow as long as the tables of averages seem to indicate.

Franz Boas.

Clark University, Worcester, Mass., April 25.

THE BROOKLYN INSTITUTE AND POLITICAL SCIENCE.

The Brooklyn Institute of Arts and Sciences is an institution that has earned a national reputation for its unique and successful educational work. Founded in 1824, it began five or six years ago, under the direction of Professor Franklin W. Hooper, a career of greatly increased usefulness and influence. To-day it has nineteen hundred subscribing members, organized in twenty-five departments of work, a property valued at $250,000, and an annual income from membership fees of upward of $11,000.

The membership of the institute, while it includes a considerable number of distinguished specialists in the various departments, is largely made up of people of general culture, and of young men and women who, without being able to continue their studies in college, are intelligent and thoughtful, and interested in one or more departments of study. The largest and, considering the standing of its members in the community, the most influential of all the departments of the institute is that of political and economic science, organized in December, 1889, with Professor Richmond Mayo-Smith, the specialist in statistical science of Columbia College, as its first president.

This department has already done a most excellent work in Brooklyn, in its department meetings, its courses of lectures upon subjects in political science, and in the addresses of distinguished speakers, given under its auspices, upon occasions of wide popular interest. It is largely to the stimulating influence of this work during the last three years, that the proposition, recently made to the department, to establish a school of political science, is due. Excellent as the lectures and anniversary meetings of the department have been, the members now demand something more systematic and specialized.

The plan proposed contemplates the ultimate establishment of a fully equipped school of political science with elementary and advanced courses in civil government, political economy, social science, and history, at nominal rates for tuition. The proposition to establish such a school was enthusiastically received at the recent annual meeting of the department; the only question now is as to the proper ways and means for putting the plan into practice.

It is evident that there are grave difficulties in the way of the successful carrying out of such a project. The lack of uniformity in the acquirements of the membership of the institute, and the influences tending to interfere with a faithful attendance upon courses once begun are not so great obstacles as the difficulty of finding instructors with the qualifications requisite for this particular work. The executive committee of the department, to whom the whole matter was entrusted with power to act according to their judgment in the matter, will not be likely to move hastily. Should sufficient encouragement be offered in the way of a moderate endowment, the school may be opened in the fall, and courses in some of the above mentioned subjects offered for 1892–93.

PREPARATION FOR THE STUDY OF MEDICINE.[1]

Incomplete is a discussion of this subject that does not include a consideration of the great value of an elementary knowledge of Latin and Greek.

I here most seriously disclaim any attempt to prove that devotion to Latin and Greek for the purpose of reading the literature of these languages is either requisite or even desirable as a preparation for the study of medicine. The field of modern literature and of modern science has become so vast and important that the average student will find neither time nor relative profit in the attempt to *master* the ancient classics.

I do, however, earnestly advocate the study of the rudiments — I mean simply the rudiments — of Latin and Greek, as most valuable labor-saving instruments in acquiring an English, a scientific and a medical education.

I ask indulgence, if I dwell somewhat at length on this portion of my subject, for I think we are in danger of losing sight of the many and great benefits, which every true student will receive from a judicious study of some things in

[1] Address of President E. L. Holmes Rusk, Medical College, Chicago.

these living dead languages. My argument turns on the word judicious — as applied to the extent and method of the study. The old methods, as unphilosophical as they well could be, and the undue time and labor devoted to the classics are worthy of radical change in the modern system of education.

Consider the vast array of technical terms and of common English words in our general and scientific literature, which are also pure Latin and Greek words. Look at this remarkable series of paradoxes! A young man may never have learned a single word of Latin or Greek, and yet under ordinary circumstances he has learned by hearing and reading English several hundred Latin and Greek words — if he is especially intelligent, at least three thousand. When he receives his degree of Doctor of Medicine, he has learned by the most painful toil several hundred technical terms taken from these languages — and still does not know a single word of Latin or Greek. He can count in Latin and Greek and yet is in ignorant bliss of the fact, for he could not give on demand a single numeral of these languages. He already knows the names of several colors, of several of the elements, and yet cannot tell one of them. He knows the Latin and Greek names of every member of the body, of every organ, tissue, fibre and fluid and of all their diseases, of all the senses and functions, and the words to express writing, describing and measuring. If, however, he was asked to give the Latin and Greek synonyms for any of them he could not give it.

Now for the pith of what I have to say! A rudimentary Latin, as also a Greek, grammar with the readers should be constructed for the primary object of teaching English — secondarily of teaching Latin and Greek.

The Latin grammar, save perhaps fifty connectives and other important words should contain scarcely forty pages of declensions and conjugations with only a very few rules. Every word of this grammar should be a good English word with possibly a slight change of a letter or syllable.

The Latin reader should contain at least a hundred and fifty pages of pure, even elegant Latin from classic prose and from poetry, almost every word of which would be a good English word.

We will present a few examples:

"Labor omnia vincit."

"Poeta nascitur, non fit."

" facilis descensus Averno:
Noctes atquedies patet atri janua Ditis
Sed revocare gradum superasque evadere ad auras.
Hoc opus, hic labor est."

Literae adulescentiam alunt, senectutem oblectant secundas res ornant, adversis perfugium ac solatium praebent, delectant domi, non impediunt foris, pernoctant nobiscum, peregrinantur, rusticantur."

"Homo sum, humani nihil a me alienum puto."

"Pallida Mors aequo pulsat pede pauperum taburnas Regumque turres."

These of course could be preceded by many simpler sentences, such as "Tempus fugit." "Res sacra est miser."

As the multiplication table must be committed to memory before the child can progress in arithmetic, so the few pages of declensions and conjugations must be memorized, that the beginner may become perfectly familiar with Latin terminations. With this preliminary exercise the scholar would then find no perplexities and would read almost at sight all the sentences in the reader.

In the vocabulary at the end of the reader with every principal word should be arranged all cognate words. With the definition of each word should be presented all English words derived from it.

Instead of exercises in transposing English into Latin, I would for the first year direct the energies of the pupil in the discipline of memorizing by easy tasks the classic sentences I have just described.

There seems to be a growing prejudice among educators of recent times against the practice of "learning by heart." I am convinced there is no way by which one can make more rapid progress in learning a language, either ancient or modern, than by committing to memory wisely selected sentences and phrases.

This is the natural method of learning a language. The child, from the time it attempts to utter its first syllable, never speaks that syllable perfectly till it has learned it by heart. In a single year the pupil will learn far more Latin than in two or three years by the methods usually pursued in our public schools.

The same plan should be pursued in teaching the elements of Greek. Thirty pages of grammar, each word of which should be an English word, except fifty connectives and other important words, would suffice.

There would be some difficulty in filling a Greek reader with gems of Greek, which would also be English. A competent Greek scholar, however, with the aid of fifty connective words not English, could compile a few such sentences and paraphrase others. He could arrange simple narrative of facts from history, biography, geography and mythology, in which the several hundred Greek words in our language could be formed into quite long sentences and convey much useful information.

Pardon me for reading a dry list of familiar syllables to call to your minds a multitude of Greek English words which, properly arranged, would fill many pages of instructive reading — words ending in graph, gram, meter, logue, asm, scope, sis; words commencing with dia, a or an, kata, para, apo, hypo, hyper, hydro, phos, sym or syn, phil, peri, tech, tel; words in which the following are important syllables, hepat, soma, stoma, ptoma, tony, pneuma, deme, crat, arch, bion, phon, tone, sarc.

There is a great need of such elementary text-books for the use of professional students, the preparation of which is worthy the attention of any ingenious and thorough Latin and Greek scholar. As far as I am aware, those which have been heretofore arranged do not possess vocabularies sufficiently extensive for the use of the medical student in studying technical terms. The portion devoted to grammatical forms is also inadequate. Moreover, the quotations and other sentences are not selected with reference to their elegance of expression and beauty of sentiment, which render them suitable for memorizing. Nor do they seem to be selected with special reference to the useful knowledge they convey.

The vocabulary should be sufficiently extensive to present not only all words used in our general literature, but also in the sciences. The following examples will illustrate my meaning: —

Tango, tangere, tetigi, tactum (contingo, contingere, contigi) = To touch. Tactus = Sense of touch. Tangent, tangible, intangible, tact, intact, contact, contiguous, contiguity, contingent, contingency (integer, integral ?).

σαρκαξω = To tear flesh like dogs.	Sarcasm, sarcastic.
σαρκιξω = To play.	Sarcousa, sarcosis.
σαρκικος = Fleshy.	Sarcous, sarcocele.

σαρκοφαγος = Flesh consuming. Anasarca.
σαρξ-κος = Flesh. Sarcophagus.
"κακων πε λαγος"
κακος = Bad, evil. Cacodyle — cachectic, cacexy — cacoethes, cacophony.
πελαγος = The Sea. Archipelago.

After this study of English, Latin, and Greek, the student can understand without difficulty the technical terms of every science in every modern language. He is also able to trace the derivation and meaning of new terms which are constantly formed in every department of knowledge.

He possesses the key by which he can acquire two modern languages in the time otherwise required for one; he enjoys a deeper insight into the spirit of all literature; he has a systematic knowledge of sufficient Latin and Greek to enable him to continue alone his reading of the classics if he has the time and taste so to do; he has increased and perfected the vocabulary of his own language, which, in very great degree, is a measure of mental development, and which possesses an intrinsic value almost beyond estimation.

This course is relatively easy, since the pupil makes use, through every step, of a large vocabulary which he has in great measure already at his command. After he has once learned the inflections, he makes rapid progress in comprehending the simpler forms of construction. He soon recognizes at a glance important "stems" in English words, even when they are disguised, as in microbe and autobiography, in telescope and episcopal, and in chylopoetic and poetry.

A vast majority of pupils in our high schools drop their studies at the end of their second year. They have spent so much time in struggling with an absolutely strange vocabulary and idioms that they have learned very little English and still less Latin and Greek. By the plan here advocated, they will have made progress in their own language and acquired considerable knowledge in the ancient languages — an excellent foundation for further study in any field. They will have stored their minds with many beautiful sentences, epigrams, mottoes, and gems of thought.

This course will not materially conflict with any method which a teacher may prefer.

NOTES AND NEWS.

AT a meeting of the Botanical Club of Washington, held April 23, 1892, a committee was appointed to consider and report upon the questions of a botanical congress and botanical nomenclature. At a special meeting, called May 7, this committee presented a report, which was unanimously adopted by the Club, to the effect, that, while favoring the final settlement of disputed questions by means of an international congress, they do not regard the present as an opportune time, but that they recommend the reference of the question of plant nomenclature, first, to a representative body of American botanists; they suggest the consideration, by such a body, of the following questions, among others: The law of priority, An initial date for genera, An initial date for species, The principle "once a synonym always a synonym," What constitutes publication? The form of ordinal and tribal names, The method of citing authorities, Capitalization; that they recognize the Botanical Club of the A. A. A. S. as a representative body of American botanists, and commend to that body, for discussion and disposal, the subject of nomenclature as set forth in these resolutions. The report was signed by Lester F. Ward, Geo. Vasey, F. H. Knowlton, B. T. Galloway, Erwin F. Smith, Geo. B. Sudworth, Frederick V. Coville.

—M. Faure has recently invented a process of producing aluminium, according to *Engineering*, by means of which he hopes to reduce its price to about 8d. or 9d. a pound. Briefly speaking, his proposed method consists in obtaining, in a cheap manner, aluminium chloride and decomposing it electrically. This decomposition can be effected with a smaller potential difference than can that of the fluoride most frequently used for preparing aluminium by electrolysis, and at the same time a valuable bye-product is formed in the chlorine liberated. It is said, however, that there are considerable difficulties in the way of making the proposed process a commercial success.

— Opinions are being expressed by scientific workers in India, says *Nature*, in favor of the making of systematic experiments with snake poison. The Committee for the Management of the Calcutta Zoological Gardens are constructing, from private subscriptions a snake-house with the most modern improvements, which will contain specimens of all the principal poisonous snakes in the country. If the necessary funds were available, arrangements could be made to fit up a small laboratory in connection with the snake-house, for the purpose of conducting inquiries of all descriptions bearing upon the pathology of snake-bite and cognate subjects, and in future there would be no difficulty in arranging for the carrying out of any special experiments that might be required. It is understood that Dr. D. D. Cunningham, F.R.S., President of the Committee, would in that case be willing to take an active part in organizing and promoting such inquiries and carrying out such experiments, including the testing of the various alleged remedies for snake-bite, which are from time to time brought to notice.

— Captain Bower of the Indian Staff Corps has arrived at Simla from China, after a very remarkable journey across the Thibet Tableland, according to *Nature*. He had with him Dr. Thorold, a sub-surveyor, one Pathan orderly, a Hindoostani cook, six caravan drivers, and forty-seven ponies and mules. The Calcutta correspondent of the *Times*, who gives an account of the journey, says that Captain Bower, leaving Leh on June 14, crossed the Lanakma Pass on July 3, avoiding the Thibetan outpost placed further south. Journeying due east, he passed a chain of salt lakes, one of which, called Hor-Ba-Too, is probably the highest lake in the world, being 17,930 feet above the sea. Gradually working to the south-east, the explorer saw to the north a magnificent snowy range, with a lofty peak in longitude 83° and latitude 35°. After many weeks' travel over uplands exceeding 15,000 feet in height, where water was scarce and no inhabitants were to be seen, the party on Sept. 3 reached Gya-Kin-Linchin, on the northern shore of Tengri Nor Lake, in longitude 91° and latitude 31°. This is within a few marches of Lhassa, and two officials from the Devi Jong, or temporal governor of Lhassa, met him here and peremptorily ordered him to go back. But he refused to return, and a compromise was effected, guides and ponies being provided on his agreeing to make a detour to the north in order to reach the frontier of Western China. He reached Chiamdo on Dec. 31, only just succeeding in getting off the tableland before winter set in. He struck Bonvalot's route for a few miles when marching to Chiamdo. The country about this town is very fertile and well wooded. Three thousand of the monks of Chiamdo, who lived in fine monasteries, threatened to attack the party, but were deterred on learning that they carried breech-loaders. Captain Bower arrived at Tarchindo, an outpost on the Chinese frontier, on Feb. 10. The distance covered from Lanakma to Tarchindo was over 2,000 miles, all of which, save a few miles, has now been explored for the first time. The route for thirteen consecutive days lay over a tableland 17,000 feet high. Captain Bower is engaged in writing a report and completing his maps.

— "Of late years a considerable, and perhaps a disproportionate, amount of attention," says *Lancet*, "has been devoted to the scientific explanation of the state of unconsciousness. The public, as well as the professional, mind has been treated *ad nauseam* to discussions on hypnotism. The relations of trance and sleep to each other and to various phases of disease have elicited their share of logical ingenuity and of research. Quite recently again an allied condition — that of the numbed sensation consequent upon shock, such as that experienced in falling from a height — has attracted attention, though, beyond the assurances of some who have survived this experience that dread and pain are alike absent, we have no certain proof of the existence or the essential

character of this merciful torpor. According to Professor Heim of Zurich, who has devoted much time and thought to the investigation of the subject, the sensations at such a time of the sufferer, if so he can be termed, resemble somewhat those of drowning persons. In place of pain there is a process of rapid and involuntary mental activity, succeeded by stupor; series of old memories fly past the mind like scenes in some rapid vision, and life is revised, as it were, on the threshold of death. One is naturally tempted to inquire what is the explanation of this extraordinary state, in which the final catastrophe appears to be lost in the dream-slumber preceding it. The preoccupation of rapid cerebration, a species of shock in itself, might furnish a clue to the mystery — at all events, as regards the abolition of pain and fear. We cannot help thinking, however, that other causes must be operating along with this, which at first presents itself as the most obvious. The analogy afforded by drowning is, to our mind, especially suggestive. We may remark that here we have to do with a highly probable alterative of normal brain function in the stimulant-sedative influence of a disturbed circulation. The advent of asphyxia implies the turgescence of all venous channels and capillaries, and the increasing accumulation in these of carbonic acid. It appears to us that the same process must occur in falling. As a rule the fall takes place with head downwards. At the same time there is exerted upon the respiratory passages the suction force of the outer air in rapid transit, acting, we may conclude, in much the same manner as water in a large tube, which draws into its own volume the fluid contents of any small communicating channel. Thus it would seem at least a reasonable hypothesis that the coma of death in the circumstances referred to, like the same condition in various forms of disease, is essentially a process of deoxidation of tissue with accumulation of carbonic acid."

— A preliminary paper "On Drift or Pleistocene Formations of New Jersey," by Professor R. D. Salisbury, has been issued by the Geological Survey of that State. The detailed survey of the Pleistocene (drift) formations of New Jersey was begun about the first of July of last summer. It is the purpose of this survey to prepare maps which shall represent the distribution and the relation of the various types of drift formed by the ice, and by the waters emanating from it, during the glacial or Pleistocene period. It is also the purpose of the survey to prepare maps showing the distribution and relations of such other formations as shall be found to exist within the State, which were made contemporaneously with the drift, or during any part of the Pleistocene period. With each sectional map of the Pleistocene formations it is proposed to publish a descriptive text, explaining and describing the nature of the various formations mapped, the method by which they originated, their relations to each other and to underlying formations, and the notable changes which they have undergone since their formation. Along with such descriptions, which will be adequate to the understanding of the maps, and of the surface formations of the areas represented on the maps, there may be suggestions concerning the economic significance of the formations. Obligations contracted before this work was undertaken have limited the time which has thus far been devoted to it. Of the two months spent in the field, a considerable part was given to a general reconnoissance of that part of the drift-bearing area adjacent to the terminal moraine. Some of the general results of this reconnoissance are embodied in the report. In addition to the work of reconnoissance, the detailed study and mapping of the surface formations has been begun, and has covered that part of Middlesex County, which lies north of the Raritan, most of Union County, and the south-eastern portion of Essex County. Under the circumstances it was deemed advisable to make this report no more than a general discussion of the drift and of the Pleistocene formations in general, with especial reference to the phenomena in New Jersey. This report may therefore be regarded as in some sense a preface to the more detailed reports which will follow when the work which must form their basis is completed.

— The eighth annual meeting of the Conference of State Boards of Health will be held in Lansing, Mich., June 6, 1892. The meeting will convene at 10 A.M., in the Senate Chamber of the State Capitol. Governor Winans will informally receive the members of the Conference in the Executive Rooms in the State Capitol during the day or evening of June 6. The local committee has expressed the hope that the time of the members of the Conference will permit of their visiting the three other State institutions located at Lansing. Headquarters will be at the Hotel Downey, where special rates have been secured. The following questions for the consideration of the Conference have been received by the Secretary: Proposed by the State Board of Health of Connecticut, (*a*) What is the most practicable way of providing a hospital for contagious diseases for a town or community of a population of 5,000, the same to be always ready for the reception of patients? (*b*) What will be the average cost of maintaining it, per annum; the probable number of patients it would be called upon to receive being regarded in the estimate? Discussion opened by Dr. L. F. Salomon of New Orleans, La., and Dr. Louis Balch, Albany, N. Y. Proposed by the State Board of Health of Indiana, How strict should the quarantine be in cases of diphtheria and scarlet-fever? Discussion opened by Dr. Thos. J. Dills. Ft. Wayne. Ind., and a member of the Iowa Board of Health. The Michigan Plan of Sanitary Conventions, by Professor Delos Fall, Albion, Mich. Proposed by the State Board of Health of Louisiana, (*a*) What should be the relations of State and County Boards of Health? (*b*) What should be the relation of State Boards of Health to National Authorities? (*c*) What should be the relation of State Boards of Health to the State? Discussion opened by Dr. C. P. Wilkinson, New Orleans, La. Proposed by the State Board of Health of Pennsylvania, In view of the increasing frequency of communication between the Republic of Mexico and the United States, and of the constant prevalence of typhus fever in the former country, is there such probability of the introduction of that disease into the United States as to make it important for health officers along the southern frontier to use especial vigilance on that account? Discussion opened by Dr. Robert Rutherford, Houston, Tex., and Dr. L. F. Salomon, New Orleans, La. Proposed by the State Board of Health of Ohio, What measures can be enforced to prevent the spread of infectious diseases in rural districts? Discussion opened by Dr. J. T. Reeve, Appleton, Wis., and Dr. J. Berrien Lindsley, Nashville, Tenn. The relation of the Laboratory of Hygiene to the work of the State Board of Health, by Professor Victor C. Vaughan, Director of the State Laboratory of Hygiene, Ann Arbor, Mich. Proposed by the State Board of Health of Kentucky, Should State Boards of Health be charged with the administration of medical practice laws? Discussion opened by Dr. Henry B. Baker, Lansing, Mich., and Dr. Jerome Cochran, Montgomery, Ala. Proposed by the Provincial Board of Health of Ontario, (*a*) Has intra-State, inter-State, and International action to prevent the sewage pollution of streams become a necessity? (*b*) If so, what steps are practicable for bringing about conjoint action? (*c*) What practical methods are available for preventing such pollution? Discussion opened by Dr. Benjamin Lee, Philadelphia, Pa., and Dr. P. H. Bryce, Toronto, Ont. The public health work in Michigan, by Dr. Henry B. Baker, Secretary of State Board of Health, Lansing, Mich. Proposed by the State Board of Health of Tennessee, The practical working of inter-State notification. Discussion opened by Dr. P. H. Bryce, Toronto, Ont., and Dr. J. Berrien Lindsley, Nashville, Tenn. Proposed by the State Board of Health of Vermont, The part played in the spread of tuberculosis by the flesh and milk of tuberculous cattle. Discussion opened by Dr. C. H. Fischer, Providence, R. I., and Dr. Victor C. Vaughan, Ann Arbor, Mich. Proposed by the State Board of Health of Pennsylvania, Is the disinfection of baggage essential to effective quarantine? Discussion opened by Dr. C. H. Hewitt, Red Wing, Minn., and Dr. S. R. Olliphant, New Orleans, La. The "unfinished business" includes, report of the committee to formulate a plan for the creation and organization of county and other local Boards of Health, report of the committee to make a Codification of the Health Laws of the different States and Provinces, report of the committee on the Collective Investigation of Diseases, report of the committee on Vital Statistics, report of the committee on the Prevention of Consumption, report of the committee on the Pollution of Streams, and the Formation of River-Conservancy Commissions.

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CURRENT NOTES ON ANTHROPOLOGY. — VI.

[*Edited by D. G. Brinton, M.D., LL.D.*]

Proto-Historic Ethnology of Asia Minor.

A BEAUTIFUL book, just published in London, Perrot and Chipiez's "History of Art in Phrygia, Lydia, Caria, and Lycia," sums up in an attractive manner the authors' opinions about the ethnology of Asia Minor at the dawn of history. They recognize that the evidence all points to the western origin of the Aryan peoples then dwelling there. The Phrygians, Mysians, Bithynians, Lydians, Carians, Lycians, and Armenians, all spoke languages and dialects belonging to the Aryan stock, and all can be traced back to their ancient seats in Thrace. Of these, the Lycians, whose tongue presents marked analogies to Zend and Sanscrit, were probably the first to cross the Hellespont.

This great Hellenic migration doubtless occupied centuries. It was approximately coincident with two famous events in the history of the country — the fall of the powerful Hittite kingdom, and the Trojan war; in other words, it occurred about twelve hundred years before the Christian era. The Hittites fell beneath the attacks of these Greek invaders and the forces of Ramses III. of the nineteenth dynasty. A number of them took refuge in Cyprus, as it is just at this time that the Hittite influence on Cypriote art becomes visible. Though Perrot and Chipiez do not call attention to this latter fact, it is attested by recent excavations (reported in the *American Journal of Archæology*, Sept., 1891).

A materially different sketch of the subject is that laid before the Anthropological Society of Vienna in January last by Professor W. Tomaschek. He grants that the Phrygians, Armenians, Mæonians, Skaians, and Cabali were of Aryan blood and European origin; but he denies both of these traits for the Carians, Lykaonians, Pisidians, and Lycians. All these and many smaller tribes he would group into a widespread, isolated linguistic stock, along with the Leleges of the Grecian peninsula. Its easternmost branch were the Tiburani, who lived on the western slope of the Cilician Amanus, and whom he identifies with the Tabala of the Assyrian inscriptions and the Tubal of the Book of Genesis. The Alarodi of Lake Van were another member.

Physically, this stock was short and brachycephalic, and succumbed easily to Aryan and Semitic inroads. Fragments of its language can still be collected from the current dialects of Asia Minor, especially in Cappadocia; for instance, six, *lingir;* seven *tŭtli;* eight, *mŭtli;* nine, *danjar* or *tsankar;* woman, *lada;* child, *öne;* daughter, *zzemaza;* son, *tedäeme;* etc. These words show no affinity with any other tongue. The frequent locative terminations *assus*, *essus*, and *anda*, occurring throughout Greece and Asia Minor, belong to this ancient speech, and serve to define its limits.

The culture of its members was by no means savage, as the Cyclopean walls of Hellas were Lelegian structures, and the names and worship of Apollo, Artemis, and other Grecian deities were derived from the same source. So, at least, is Professor Tomaschek's opinion, whose article is printed in the last issue of the "Mittheilungen" of the society referred to.

Ethnography of India.

Dr. Emil Schmidt is docent of anthropology in Leipzig and author of an excellent text-book, "Anthropologische Methoden." In recent numbers of the *Globus* he has given briefly the results of some of his studies on the physical characteristics of the natives of India. The article is illustrated from his own photographs and presents some highly interesting types.

Dr. Schmidt does not quite agree with the observations of Mr. Risley, to which I have alluded in *Science*, April 8. His own classification of the native types is as follows: –

1. Narrow nosed, fair skinned.
2. Broad nosed, fair skinned.
3. Narrow nosed, dark skinned.
4. Broad nosed, dark skinned.

No. 2 he acknowledges is merely a mixed type, resulting from intermarriage of the white Aryan with the Dravidian stock. The real contention comes on No. 3, the narrow nosed, dark skinned type. An example of these are the Klings, day-laborers, constantly seen in the commercial cities of the Straits and the neighboring islands. They are considered of Telugu or Tamil origin, but have fine and regular features, symmetrical bodies and superior beauty; yet their color withal is often that of the darkest shades of the scale. They have been considered of mixed descent, but against this theory their hue and the fixity of the type seem to militate.

In conclusion, Dr. Schmidt expresses himself as opposed to designating the two ground-forms of Indian ethnic types by the terms "Aryan" and "Dravidian;" because these are rather linguistic than ethnographic designations. Better, he thinks, refer to them as light and dark, platyrhinic and leptorhinic types.

The Identity of Primitive Art-Motives.

It would be well worth while for those who seek to establish ethnic affiliations or prehistoric connections between nations, on the basis of the identity of their art and decorative designs, to peruse carefully the little work of Professor Alois Raimund Hein of Vienna, "Mäander, Kreuze, Hakenkreuze, und Urmotivische Wirbelornamente in Amerika" (Wien, Alfred Holder). It is the result of nearly a score of years' study of stylistic ornament and the development of design.

In this essay the author has confined himself to art-motives found among the native tribes of America, numerous exam-

ples of which he analyzes with a master hand. He reaches the conclusion, which I am convinced can never be overthrown, that the original and primitive expressions of the artistic sentiment reveal themselves everywhere in a series of motives which display a surprising and almost complete similarity. This practical identity continues high up in the evolution of art-forms. It is not to be attributed to any historic connection between nations, nor to any prehistoric relations or instruction, but solely to the unity of mind and its expressions through all humanity. "Thousands of ethnographic, religious, symbolic and artistic parallels, with which ethnography and archæology are making us familiar, are easily explained by the organic faculties of the mind of man. This is true for all zones and for all lands of the earth where man has slowly developed from simple to complex artistic conditions." Were these maxims fully understood, we should have fewer attempts to trace Greek and Assyrian back to Egyptian, or Central American back to Asiatic art, than has of late been the case.

Native Fairs in Alaska.

The early conveyance of articles of Asiatic manufacture far into America is matter of surprise for no one who is acquainted with the commercial and migratory habits of the natives of the Northwest Coast. As slaves are part of their stock in trade, Asian blood and features were introduced without a general or even partial migration of Siberic tribes across Behring Straits, for which, *du reste*, there is no evidence at all.

The times and places of these fairs were recenty stated by Mr. I. Horner from information supplied by Lieut. Miles C. Gorgas, U.S.N., in an address to the Numismatic and Antiquarian Society of Philadelphia, as follows: Beginning at the south, a fair is held in June at Port Clarence, just south of the narrowest part of the Straits. It is numerously attended by the Chukchis of Siberia, the natives of St. Lawrence Island, south of the Straits, and by others from Cape Prince of Wales on the American mainland. The second fair is held at Wotham Inlet on the north shore of Kotzebue Sound. It lasts through July and August, and is attended by about 1,500 people, some Siberians, but mostly natives, especially from Point Hope, these being the principal traders of the coast. A third fair is at Point Lay, and a fourth at Camden Bay, not far from the mouth of the Mackenzie River.

The trading boats make a regular round of these fairs, carrying articles in demand from one to the other; so that some from the far interior of Asia will in a few years be transported along the shores of the Arctic Sea, and southerly indefinitely into the centre of the continent. This has doubtless been going on for centuries, and would explain the presence even of Japanese and Chinese articles in ancient burial places — if such were ever found.

NOTES ON LOCAL JASSIDÆ.

AN interesting feature in the study of entomology is the fact that there are still a great many untrodden paths and plenty of work for the discovery of new species. In the Hemiptera there are still many forms unknown to science. In my collection of two or three seasons Professor Edward P. Van Duzee has found several new species; but only those belonging to the *Jassidæ* will be noticed here.

In his admirable paper on the genus *Phlepsius*, recently published by the American Entomological Society of Philadelphia, he enumerates several new species, and groups others under that genus, which to many have been known under other names; for instance, what we have known as *Bythoscopus strobi* Fitch is now to be known as *Phlepsius strobi* Fitch. This decision was rendered by Professor Van Duzee in 1890, and published in *Psyche*.

Our old and well-known species *Jassus irroratus* Say is now to be known as *Phlepsius irroratus* Say; it was at one time known as *Allygus irroratus* Uhler; and Burmeister, Walker, and Uhler knew it as *Jassus testudinarius* Burm.

The genus *Phlepsius* as now arranged by Professor Van Duzee is a step in the right direction, and his "synoptical table" of the species will be a great help to Hemipterists in studying this order of insects; it bespeaks a future for it and a basis for study equal to that projected by our able fellow-townsman, Professor Ezra T. Cresson, in the Hymenoptera.

The species in the Jassidæ taken by me in the locality of New York City number eighteen or more, some of which have as yet not been determined.

Phlepsius strobi is, according to our record, quite a rare species. Professor Van Duzee records but five specimens. Mr. Uhler's lot only contained one male from Fitch, and two specimens from Texas, one specimen from D. S. Kellicott, Ohio, and one female from myself. We notice by this the wide distribution of the species, yet but five specimens are recorded in Professor Van Duzee's paper.

It would be interesting and valuable to hear from the Entomological Society of Philadelphia, as well as from Professor Riley for the Government, in regard to this insect; also from Professor Osborn, who would know it, but, if he had had it in his collection, he would probably have sent it to Professor Van Duzee, to assist him in making up the valuable revision of this genus.

Phlepsius fuscipennis Van Duzee is a new species found by Professor Uhler and myself, and described from one pair sent him by Professor Uhler and fourteen males and two females sent by myself. Here, again, we have sufficient distribution to warrant the recording of more specimens; and we would like to hear from any source as to their habitat in other States; and this could be soon found out, were those species not known to collectors, and now in their collections, sent to Professor Van Duzee, for identification. With us they seem to be fairly abundant, and are exceedingly interesting, both on account of their rarity and markings.

Professor Van Duzee states, "that the dark colored species may be distinguished by their broad form, short impressed vertex, and strongly wrinkled pronotum; the brown elytra of the males, spotted with white; some of the males exhibit the pale arcs on the front, and the ocelli may be black."

Phlepsius fulvidorsum Fitch has been taken by myself, but in limited numbers. It seems to have quite a wide distribution; but as yet Professor Van Duzee records as known to him but ten (10) specimens, and these from New York, Iowa, Maryland, and Texas. This must be a difficult species to determine, for, as good an Hemipterist as Professor Van Duzee is, he finds great difficulty in distinguishing between two predominant forms, which can only be well done by the study of a large series of specimens from an extended area; and if all who are interested in this order would send specimens to him and assist him, he would no doubt soon solve the problem and explain it to us so we could also know wherein the difficulty lay

Another new species, described by Professor Van Duzee

and taken by myself, is *Phlepsius humidus* Van Duzee. Though not uncommon, this species is recorded but once outside of New York State, by two or three examples labeled Delta R.R. I have taken it quite frequently, and Professor Van Duzee says "it is not uncommon about Buffalo, in low, swampy meadows and other humid situations." He has also taken it near Lake Ontario, and states that this is the "large variety mentioned in his list of Hemiptera from that locality, published in the *Canadian Entomologist*, for 1889, under the name *Allygus irroratus* Say."

Jassus excultus Uhler is now to be known as *Phlepsius excultus* Uhler. This species is well recorded from New York, through Texas, to New Mexico. As yet I have not collected this species, nor does Professor J. B. Smith, in his "Catalogue of the Insects of New Jersey," record it from that State. A thorough search will no doubt reveal its whereabouts in this locality also.

Among the Jassidæ collected by me in this locality, and determined by Professor Van Duzee, is *Cicadula 6-notata*. It is very common and easily taken with a sweep-net.

Jassus subfaciatus Say is also common, and Professor Smith records *Jassus clittellarius* Say, and *Jassus irroratus*, now known as *Phlepsius irroratus* Say. *Athysanus* (grypotes) is represented in my collection by four species, taken here, *tergatus* Fitch, and *unicolor* Fitch, and two new species named by Professor Van Duzee as *Athysanus galbanatus* Van Duzee and *Athysanus viridius* Van Duzee. None of the species are very abundant; and they are represented in my collection by from three to six specimens, although the former two species are much more abundant that the latter. Professor Smith gives *A. fenestratus* Fitch, *minor* Fitch, *nigrinasi* Fitch, *variabilis* Fitch, *striatulus* Fallen, and *unicolor* Fitch, as *Jassus unicolor* Fitch. No doubt all these species are found here, and as far as Fitch's types are concerned, we believe, belong to this State.

In Deltocephalus I have collected *inimicus* Say, and *Sayi* Fitch, both being quite rare as far as my collecting goes. Professor Smith has *inimicus* Say recorded as *Jassus inimicus* Say. *Scaphaideus* is represented by two species, one of them new to science, and the other *Scaphaideus immistus* Say.

Athysanus is represented by *Curtisii* of Fitch, which is not uncommon with me.

In the sub-family Typhlocibinæ, we have *Typhlocyba rosæ* Fitch, and other species not yet determined, one species being very common on *Ptelea trifoliata, L*, and of a delicate green color. One of the undetermined species may be *trycincta* of Fitch, and recorded by Professor Smith as occurring in New Jersey.

Erythroneura vitis Harris is common with us; but I have not as yet found *comes* Say, or *vulnerata* Fitch, both found and recorded from New Jersey, and the latter from New York State also.

In the genus *Empoa*, Professor Smith records *guerci* Fitch, *fabæ* Harris, and *rosæ* Harris, the latter now known as *Typhlocyba rosæ* Fitch, as before noticed.

Professor Smith also records *Cœlidea olitoria* Say, and *C. subbifasciata* Say. I have not as yet collected any of this genus, although, in the present unsettled state of the arrangement in several of the orders, it is quite impossible to state just what one has, until such an arrangement as Professor Van Duzee has given us with the genus *Phlepsius* is worked out for all the families.

It is to be hoped that hemipterists and all entomologists will assist specialists by sending them specimens; and more accurate data should be given, with the material, than, I must confess, I have been able to give in the past, so that distribution and numbers may be determined.

Edmund B. Southwick, Ph.D.
The Arsenal, Central Park, New York.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

Readjustments of the Loup Rivers: Examples of Abstraction Due to Unequal Declivities.

Regretting that my article on the "Evolution of the Loup Rivers" has been misunderstood, partly on account of an error in drawing the map, I present herewith a corrected map (Fig. 1), showing the true location of the old channel connecting the head of Wood River with the South Loup at Callaway, also some additional features not shown on the first map.

In responding to the call of Professor Davis for "examples of the lateral abstraction of one stream by another *on a slope of planation*," I must premise that planation is wholly distinct from abstraction. The efficient factor in the former process is latteral corrosion, in the latter headwater erosion. Planation shifts one stream bodily over to another, whereupon both unite in that channel, below the point of contact, which is the lower of the two. In the process of abstraction the capturing stream does not itself shift over to the captured stream, but extends one of its tributaries across the original divide by headwater erosion.

Omitting, therefore, the phrase "on a slope of planation" from the question as propounded by Professor Davis, I will say that the phenomena in the Loup valley are such as to raise a strong presumption at least that some abstractions have occurred. As he remarks, "the slopes are in the proper direction for such abstraction." Moreover, the old empty channels are there as silent witnesses of adjustments already accomplished, and the ravines of greater slope and more vigorous erosion, leading into that stream which lies at a lower level to the north-east, have already captured much more than half of the space between streams, thus threatening further abstractions in the future.

In addition to the one at the head of Wood River I would cite as another example of abandoned channels the depression leading up to the Dismal River in the line of Mud Creek, the approximate position of which is roughly indicated by dotted lines, marked "Old Channel" on the map. Mud Creek is a weak stream in a great valley, itself as eloquent a witness of change as the dry valley above. It must have carried a large volume of water, and have been a worthy mate to the Middle Loup, before it was beheaded by the Dismal, a vigorous tributary of its neighbor on the north-east — the winning side in all these re-adjustments.

To show the actual position of existing divides, as indicating further abstractions, I have traced the water-shed by dotted lines for some distance between the North and Middle Loups, and between Cedar Creek and the North Loup and Calamus River. On the latter line the distances are 18½ miles from the divide to Cedar Creek, and 4½ miles to the Calamus. The eastward stream has already captured three-fourths of the territory. On the former line, at the south-east end, the divide is 12 miles from the North Loup and 6½ miles from the Middle Loup. Here two-thirds of the divide yields allegiance to the eastward stream. At the north-west end of the same line it will be observed that the water-shed is nearer to the North Loup than the Middle Loup. This is because the North Loup is a re-adjusted stream above the mouth of the Calamus. If we measure from the latter, which is the true original head of the North Loup, the divide assumes its normal position nearer to the higher stream lying to the south-west. The larger and longer stream, called the North Loup on account of its size, is really an overgrown tributary, which owes its superior vigor to the fact that it now flows more nearly in the line of maximum gradient than does the Calamus, or the unadjusted North Loup

below the confluence. The energy of westward headwater erosion is unmistakable. All of the Loups bend that way at their heads, and have their most vigorous tributaries on that side.

It is noteworthy that the North Loup, having no large, aggressive eastward neighbor, has retained its original head, the Calamus. It has itself encroached upon the territory of the Middle Loup, but that stream escaped capture by turning aggressor on its own account. Possibly its original head was captured by the North Loup. If so, it was after the Middle Loup had seized so much territory westward, including the head of the large valley in which Mud Creek now flows, that the conquest was a barren one. It was no more serious in its effects upon the Middle Loup

FIG. 1.

Drainage map of Central and Eastern Nebraska. The dotted lines along the Middle and North Loups mark the present water-shed, lying in each case nearer to the higher stream to the south-west. The short stream near *x* is Lost Creek, so called because it disappears in the sands of the valley. The line *xy* shows the trend of the buried cliffs of Cretaceous shales bounding the old gorge of the Platte.

than the capture of the Calamus by a tributary of Cedar Creek would now be to the North Loup.

Professor Todd has added some welcome and valuable contributions to this discussion (*Science*, Mar. 11, p. 148), but his objection to the "efficiency of abstraction," on account of the porosity of the strata in this region, does not appear to me to be well taken for two reasons. First, the impression given by his remarks, of the degree and extent of porosity, is exaggerated. It chimes with a widespread popular notion of extensive subterranean flows from one river to another, but the real exceptions to that general hydrographic law which predicates the volume of each river to be the product of rainfall on its own basin, are not much more frequent or striking here than elsewhere. There is no indication that the Blue receives any appreciable increment by subflow from the Platte, or the Salt from the Blue, although both are at a lower level than the larger stream to the west. Each has a volume which may all be accounted for by the size of its basin and the depth of annual precipitation. Those tributaries of the Salt which approach nearest to the Blue are the weakest; if subflow from the Blue were an important factor they should be the strongest. The divide is formed by a moraine of the first glacial epoch, running along the east bank of the Blue, where the words "Big Blue" are written on the map. This moraine is the cause of the peculiar arrangement of the tributaries of Salt Creek, and of the abrupt turn to the south of all the Blue rivers to form the Big Blue. It has the usual composition of a moraine — sand, gravel, and clay. Many examples of morainal lakes held up, and rivers turned aside, by such material, testify to the fact that it is not very porous.

Secondly, headwater erosion would not cease on account of subflow unless the latter absorbed the whole run-off. As long as there are any surface streams, and they are rather numerous in this region, they will erode their channels and, by virtue of the law of unequal declivities, push the divide towards the higher stream, ultimately abstracting the latter. If the subflow does rob them of some part of their volume and eroding power, the process will only be retarded, not prevented.

I leave it to Professor Todd to answer the question of Professor Davis respecting the deflection of rivers by rotation of the earth. He has already adduced the Platte as an example, assuming it to have flowed once in the channel of the main Loup. The accompanying profile (Fig. 2), reduced from one published by Chief Engineer E. S. Nettleton (Irrigation Survey, U. S. Dept. of Agriculture Progress Report, Part II.), will be useful in discussing this assumption. The Loup at St. Paul is 95 feet below the Platte at Grand Island. Since rivers do not shift from lower to higher levels, it is physically impossible that the Platte should have shifted from the Loup channel to its present position, unless there has been a great change of levels. But such change is claimed. Professor Todd thinks the Platte occupied the Loup channel ("the north channel already described" cannot be other than that of the main Loup, since it is said that "the Loups did formerly flow through to the Platte" in that position) "when it was flowing on a level seventy-five to a hundred feet higher, relatively, than at present." This would bring it up to the position of the dotted line O. C. Fig. 2, one hundred and ninety-five feet in the air above the present Loup. There are no flood-marks, or other evidences, to show that it ever flowed there. The "alluvian terrace," which is the most significant and interesting feature of Professor Todd's map, in its westward extension along the Loup, is obscured by a range of sand hills, which form a broken and ragged divide between the Loup and Prairie Creek. Its main mass, aside from the dunes blown up on its back, is *below the present channel of the Platte*. It therefore furnishes no evidence that the Platte ever flowed at a higher level between St. Paul and Grand Island. On the contrary, it furnishes distinct evidence that the same relative levels, the same relative gradients (the Loup having less fall than the Platte) and the same relative positions of the two streams existed as far back as the second glacial epoch, substantially as they now exist. Some obstruction at that time in the lower Platte, possibly an ice-dam near Fremont, raised the waters till they overflowed the divide at the head of Sand Creek. It is surprising that this new short cut did not become the permanent channel of the Platte. Possibly the ice-dam extended below Ashland, but with less elevation than at Fremont, thus permitting the new channel to be cut down to its level, but not to the level of the old channel. Hence the longer course by way of Fremont was resumed when the ice retired.

Both the Platte and the Loup are so heavily charged with sediment that a slight reduction of their gradients would cause deposition of silt, and this result of retarded flow would be felt in both streams far above the obstruction, but farther up the latter than the former on account of its lower gradient. The ice-dam ponded the Platte for some miles above it, producing still water, in which sediment rapidly accumulated. Thus was built up the eastern end of the terrace to a level "seventy to ninety feet above the

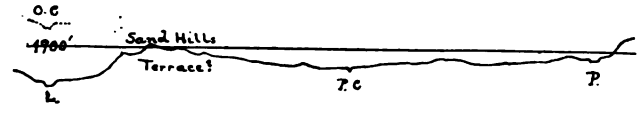

FIG 2.

Profile across the Loup, Prairie Creek, and Platte, running from St. Paul to Grand Island, Neb. Horizontal line 1900 feet above sea-level. *L.*, Loup River, 1775 ft.; *P.C.*, Prairie Creek, 1843 ft.; *P.*, Platte River, 1870 ft. above sea-level; *O.C.*, alleged old channel of the Platte.

Platte." Deposition, induced by retarded flow, an indirect result of the obstruction, extended far up the Loup on account of its low gradient. Professor Todd's map is correct in representing the terrace as following the Loup instead of the Platte above their confluence. From Columbus westward it is a Loup formation. Not only does it draw away from the Platte, but it also sinks below its level. It therefore furnishes no evidence of a change of levels, or of a shifting of waterways, but rather of the persistence of both as they now exist, since it fits well into present conditions.

Another reason for doubting this alleged shifting of waterways is found in the position and trend of the ancient rock trough of the Platte. Its buried bluffs of Cretaceous shales have been just touched by recent erosion sufficiently to reveal their existence near the mouth of Beaver Creek, along Cedar Creek, and in the bed of the main Loup between the mouths of these two creeks. The trend of these ancient bluffs is shown by the line *xy* on the map. It is oblique to the Loup channel, leaving the mouth of Cedar Creek, and of all three of the Loup rivers, *outside of the Platte valley*. If they ever entered the Platte directly and independently, it must have been as indicated in my article of Jan.

29, 1892. The eastward prolongation of the ancient bluffs is probably not continued in the line *yx*. but bending east about where the turn occurs in the courses of Lost Creek and Shell Creek. The former is a considerable stream so long as it has the impervious Cretaceous shales for a substratum, but soon disappears when it encounters the deep mass of silt in the Platte valley.

There is no evidence, so far as I know, that the Platte has ever shifted out of its old rock bed, except during the transient episode at Sand Creek. The existence of a gorge excavated in Mesozoic and Palæozoic rocks, once five hundred feet deep though now silted up to its brim, is the best reason for its present course. Nor can any inferences respecting the influence of rotation be drawn from the trend of this gorge, for the reason that a considerable part of it was formed by a stream which flowed *west*. When the Platte first stretched across the plains, its several parts of different ages and opposite flow being united in one great river, it found a ready-made channel, to which it has, in the main, steadily adhered. The hypothesis that it once flowed in the channel of the Loup fares badly in the light of the facts, and, looking across to the southward, we find no evidence that it ever flowed in any of the numerous heads of the Blue, as suggested by Professor Davis. None of them has any marked pre-eminence over the rest, and all of them are slight recent furrows, mostly below the level of the Platte, so that it must have shifted up-hill if it once flowed in them.

The suggestion that it once flowed in Prairie Creek falls into a different category, since this stream is within the old rock trough. But it is a mere pin scratch in a wide alluvial plain, any other line of which is just as likely as that to have been the flow-line of the Platte at some period. Of course this great river has shifted about within its rocky gorge. The most significant fact in respect to the influence of rotation is that it now, in many places, crowds upon the south bluffs, as shown in Fig. 2.

It is agreeable to have the concurrence of Professor Todd in my opinion that "the Loups did formerly flow through to the Platte.' I trust he will not recede from this harmonious attitude in consequence of finding it impossible to put the Platte over into the Loup in order to get them together. Strictly speaking, however, that is not impossible. A big canal would accomplish it literally. The real difficulty is to get the Platte back to its present higher channel. It is not now a constructive stream, building up its bed above the surrounding country, else we might suppose that it had shifted to its present position and then built it up above the Loup. It has not probably been a constructive river at any time since the Rocky Mountain uplift emptied Lake Cheyenne, and gave the Platte such a steep gradient that it is able to accomplish a little vertical erosion in spite of its great burden of sediment. It trembles on the verge between vertical erosion and deposition, the balance inclining to the former, but so slightly that it maintains its levels with great steadiness. Herein lies another reason for doubting that great changes of level have recently occurred in its valley.

L. E. Hicks.

Lincoln, Neb.

Sistrurus and Crotalophorus.

On page xxvi. of the introduction to a work on North American Reptiles, in the "Memoirs of the Museum of Comparative Zoology," VIII., 1883, the name Sistrurus was applied to one of the two genera of rattlesnakes because Crotalophorus, the previous title, was a synonym for Crotalus, the other genus. Professor Cope, in his latest paper on the serpents, Proc. U. S. Mus., 1892, p. 624, objects to the change in these terms: "Mr. Garman has named this genus Sistrurus, on the ground that the name Crotalophorus was preoccupied at the time it was employed by Gray. This does not, however, seem to be the case. It is true that Linnæus uses it instead of Crotalus in the sixth edition of the Systema Naturæ (1748, p. 85), but the system of nomenclature thus adopted is not binomial, so that the names are not authoritative as against later ones." This makes a considerable display of lack of caution, to say the least of it. If use by Linné in the sixth edition of the Systema (as also in the seventh and the ninth editions, and the Amoenitates) was all that bore on the question there might be nothing to say. But in proposing the new name I had in mind more than appears from the citation. Linné and Gronow only were mentioned. The dates for the latter were 1756 and 1768, which brings us within the range of the tenth edition, 1758. Gronow might be put aside as unsound binomially. If so, I still had Houttuyn, 1764, who certainly regarded the names as synonymous, for he says, "De geslagtnaam deezer slangen, *Crotalophorus*, en by verkorting *Crotalus*, is afkomstig van den ratel, dien zy aan't end der staart hebben." But, again, if not allowed to go farther back than the twelfth edition, 1766, there was another authority for Crotalophorus instead of Crotalus, Vosmaer, 1768, according to whom, "De Heer Linnéus geeft de benaaming van *Crotalophorus* aan dit geslacht, in het welk hy drie onderscheidene soorten heeft opgeteekend, die hy *Horridus*, *Dryinas* en *Durissus* noemt."

Under the name Crotalophorus, 1748–68, neither Linné, Gronow, Houttuyn nor Vosmaer included any of the species of the genus defined by Gray, 1825, with the same name. That they were not binomial authorities may be urged against Linné and Gronow, but not against Houttuyn and Vosmaer, who, though they retained the earlier name, adopted the genus and the species from the tenth edition of the Systema. Linné dropped Crotalophorus for Crotalus in 1758. In 1766 he described the first species of the other genus, placing it in Crotalus, where it was kept by most authors until removed by Gray. The necessity of the change I have made in the name of Gray's genus is best shown by a concise view of the synonymy for the two genera.

Crotalus.

Caudisona Linn., 1735–47; Laur., 1768; Flem, 1822; Cope, 1861–71; Coues, 1875.

Crotalophorus Linn., 1748–56; Gronow, 1756–63; Houtt., 1764; Vosm., 1768.

Crotalius Linn., 1754.

Crotalus Linn., 1758–66; Daud., 1803; Merr., 1820; Gray, 1825–49; Fitz., 1826–43; Wagl., 1830; Holbr., 1842; Bd. and Gir., 1853–59; Dum. Bibr., 1854; Cope, 1859, 1875–92; Garm., 1883. (Many omitted. In most cases, from 1766 till 1825, a species of Sistrurus was included.)

Crotalinus Raf., 1815.

Uropsophus Wagl., 1830; Gray, 1831–49; Fitz, 1843.

Urocrotalon Fitz., 1843.

Aploaspis Cope, 1866–75.

Aechmophrys Coues, 1875. (The last four apply to particular species.)

Sistrurus.

Crotalophorus Gray, 1825–31, 1849; Holbr., 1842; B. and G., 1853–59; Cope. 1859, 1886–92.

Caudisona Fitz., 1826–43; Wagl., 1830; Bon., 1831; Gray, 1842; Yarr., 1875; Cope, 1875–80.

Crotalus Flem., 1822; Cope, 1860; Coues, 1875.

Sistrurus Garm., 1883.

S. Garman.

Mus. Comp. Zool., Cambridge, Mass.

"Scientific" Genealogy—Rejoinder, No. 2.

Quite recently I contributed to these columns (*Science*, Vol. XIX., No. 476. "'Scientific' Genealogy—A Rejoinder."—Veritas.) a brief paper intended to curb some tendencies prevalent in genealogical circles, notably untenable assumptions regarding family traits and likenesses inherited.

Since the appearance of the above article several criticisms have been sent to this magazine — rather surprising to "Veritas" for the reason that they indicated a lack of acquaintance with what he opposed in the article.

General discussions of biology, breeding of animals — human and brute — are, I doubt not, of interest and profit, only, — they hardly touch my point in the argument, and it is important in open discussion to keep to the question, — so many readers mistake a rambling generalization for argument and fact. Then, too, I object to portions of the article by "Enquirer," namely, p. 155, paragraphs 1 and 4, as mistakenly quoting my views (for light on which my article is in evidence) and also to his last para-

graph, p. 155. in which, as I read it, he eludes and dodges the question.

More and more thought in the matter only convinces me in greater degree that these words of mine "The writer does not for a moment combat the well-exhibited inheritance of peculiar appearance and traits of a man from his father or mother, his grandparents or great-grandparents, or in rare cases from great-great-grandparents, but beyond these limits the historian has little to encourage him in his attempt beyond uncertain and traditionary tales" (Rejoinder, p. 157) are safely within the truth.

Considering that "Enquirer" knows relatively nothing of $99\frac{61}{100}$ per cent of his emigrant ancestors. I still frankly disbelieve that he can locate traits or characteristics of John Doe the first, in any living descendant, with truth. However dear a hobby or theory may grow to a man, unless facts fully substantiate the theory, and it be capable of proof, it is questionable honesty and mistaken wisdom to give that theory currency as if it were fact.

As far as I can group and draw inferences from the facts, on an average the maternal blood has almost, if not full as much, influence in determining the traits and appearance of offspring as the paternal,— this with reference to human beings.

With some one hundred living descendants of a man (the man and descendants included in four generations) I have had intimate acquaintance, and neither in those bearing his surname, nor the males by themselves, nor in all together, does there appear one common trait or characteristic, which state of things I consider due to the great influence of new strains of blood brought in by marriage.

Being as yet too young, personally, to claim the experience necessary to theorize concerning likenesses, I feel that my only safety is in stating fact. I have made a specialty of gathering the likenesses of my ancestors and close relations, and from oil paintings, through silhouettes, daguerreotypes, and ambrotypes to photographs, I honestly see as much in appearance derived from the maternal blood as from the paternal. Photographs are of too recent origin, however, to affect the argument I put forward.

Could those who are interested in the matter alter their point of view long enough to realize the blending, the existing cousinship, to realize that the living child of old New England parentage has relatives (sixth cousins and nearer) to easily populate Boston, Mass., and to spare, such a light will come to them as will widen, enlarge, and much more than offset the narrow views now cherished.

"VERITAS."

BOOK-REVIEWS.

Helen Keller: Souvenir of the First Summer Meeting of the American Association to Promote the Teaching of Speech to the Deaf. Second Edition. Washington, Volta Bureau. 1892. Large. 4°.

THE great interest aroused in the education of the blind and the deaf by the remarkable story of the life of Laura Bridgman is destined to be eclipsed by the most astounding educational strides of the twelve-year-old Helen Keller. Blind and deaf since her eighteenth month, she receives her first instruction in language at seven years, she learns in days what it required months for Laura Bridgman to acquire, and within a year has a fund of knowledge and a capacity for using it quite remarkable for an eight-year-old child in full possession of the five senses. Her interest in her surroundings, her retentive memory, and appreciative imagination, her capacity to learn and reproduce are wonderful enough, but they are outdone by her remarkably quick and, from all accounts, remarkably exact acquisition of vocal speech. By placing her hands upon the mouth, lips, and throat of the speaker, she learns the position of the speech-making organs when uttering the different sounds; setting her own vocal organs in the same position she reproduces the sound, correcting it according to the instructions (by the finger alphabet) of her teacher,—an acquisition difficult enough when guided by the eye, but certainly marvelous for one both blind and deaf.

It is only natural that her story should excite interest everywhere, and the present memoir of her education tells the salient points of her life. It is admirably prepared, and contains an excellent portrait and *facsimiles* of her very remarkable letters. It is to be hoped that all the details of her career will be carefully noted and that the present is only an introduction to a fuller and more complete account of Helen Keller. It is certainly proper that the sympathy in her case should be used to excite an interest in the education of the deaf and the blind, and the souvenir will aid in this meritorious work.

Bacteriological Diagnosis: Tabular Aids for Use in Practical Work. By JAMES EISENBERG, Ph.D., M.D., Vienna. Translated and augmented with the permission of the author from the second German edition, by NORVAL H. PIERCE, M.D., Surgeon to the Outdoor Department of Michael Reese Hospital; Assistant to Surgical Clinic, College of Physicians and Surgeons, Chicago, Ill. F. A. Davis & Co., Philadelphia and London. 1892.

THIS is, without exception, the worst translation that has ever fallen into our hands. Not only this, but it exhibits throughout an utter ignorance of bacteriology on the part of the translator. We cannot but express the greatest astonishment at the temerity shown by the translator in attempting the task, deficient as he evidently is not only in the knowledge of the German language but also in the subject treated. To set forth all the errors would be to write another book, so we will make but a few quotations to show that our condemnation is not too severe.

Beginning with the first page, we find in the preface "a bacteria" occurring twice instead of "a bacterium," and "bacteriæ" instead of "bacteria." In the index, Bacillus "sublilis" instead of "subtilis" is seen, which might be an oversight if it were not again misspelt at the head of the tabulated description (No. 14) which deals with this organism. We will pass over a vast number of comparatively small mistakes such as the translations "pretty" for "schön," "nourishing-ground" for "Nährboden," "faint" for "matt" (dull), "spirules" and "spirillæ" for "spirilla," "flagellæ" for "flagella," "color-glass" for "Blende" (diaphragm), "object-glass" for slide, "éprouvette" for test-tube, "whitish fimbria" for "weislichen Saum" ("whitish border" would be more the author's meaning), and "slim staves" or "staffs" for "schlanke Stäbchen" (we usually speak of "rods" when speaking of bacilli). Wherever microscopic measurements are given we find "m." (meters) instead of "μ." On pages 14, 15 and 57, minus signs are omitted from in front of temperatures ranging from —10° to —20° C., thus taking all meaning out of the translation.

Serious errors would be represented by such translations as these, taken at random: P. 17, where the growing out of the Bacillus subtilis from spores is described "Stäbchen sprossen senkrecht auf die Längsachse der Sporen aus," translated "Staves sprout in the direction of long axis of spores." P. 24, "Häufchen, die zu einer kernigen, brauner Masse mit abgerundeten Ecken zusammenfliessen," translated "heaps, which amalgamate into a seedy, brown mass." Same page, "Umfangreiche, schnelle Verflüssigung, vom ganzen Impfstich gleichmässig ausgehend; gelbliche Verfärbung," translated "Growth elaborate, yellow, and quickly liquefying. The growth spreads from the entire inoculation point." P. 53, "im Condensationswasser," translated "in the water expressed in desiccation." P. 57, "Im Darminhalt von frischen Choleraleichen und Stuhlentlerungen Cholerakranker," translated "In the intestinal canals of recently moribund cholera patients and from the fæces of the same." Same page, "Am Anfang des Stichkanals bildet sich ein kleiner Trichter, es tritt Verflüssigung längs des Impfstichs ein, an der Oberfläche entsteht luftblasenartige tiefe Eisenkung," translated "Liquefaction begins slowly, commencing at the entrance of the puncture around an inclosed air bubble." Same page again, "nach Unterbindung der Gallengänge," translated "after ligature of the intestine below the bile duct." On p. 63 one's astonishment is somewhat increased by finding "verschiedenartige Zeichnung" translated "indifferent pictures." "Wasserstoff" (hydrogen) translated "water" — "ohne Sauerstoffzufühlr" as "without addition of acid." On p. 72, "Schnittpräparaten" (sections) translated "excised preparations." On p. 79, instead of "Rausch-

brandbacillus" we find "anthrax bacillus." It is pleasing to read (p. 86) that the spore formation of Bacillus anthracis "occurs most plenteous at breeding temperature." We cannot agree that the equivalent of the German "welche in der Richtung der Längsachse der Mutterzelle auskeimen," is given in "which spring from the long axes of the maternal cells." On p. 96, where the effects of the injection of Staphylococcus pyogenes aureus into the blood-vessels are considered, "nach Lädierung der Herzklappen" is translated "later they attack the valves of the heart," and so we might go on indefinitely.

In the third German edition of this book, which appeared in 1891, 876 micro-organisms are described, whilst this translation of the second edition appears in 1892 and describes some 183 micro-organisms. The appendix belonging to the third German edition, which was not present in the second edition, has been added to the translation of the latter. We have not noticed much that is "augmented" in the translation, but much that is distorted and misstated. The climax was reached when we found the Plasmodium malariæ (not mentioned in Eisenberg at all) classified under the heading "Pathogenic Bacteria." In justice to the publishers, we are only too happy to remark that the printing, and especially the binding of this book are well done.

On one point the translator justly gives himself credit, and that is in the preface where he says, "The arrangement of the text has been somewhat changed from the original." G. H. F. N.

AMONG THE PUBLISHERS.

A GUIDE-BOOK is a *sine qua non* to the average American bound for a summer's trip in Europe. But, aside from the stock information which the regulation books of that class contain, there is a large number of questions in regard to foreign things and ways which remain open, and it is to help the tourist to just such additional and most necessary information that Brentano's, New York, has just brought out "Abroad and at Home," by Morris Phillips, the well-known editor of *The Home Journal*. In this book can be found accounts of the author's experiences while in Great Britain and France, and the close of the volume contains much similar information about our Southern States and the Pacific Coast, this last justifying the "At Home" in the title.

— Thomas Curtis Clarke, the eminent engineer, in the June number of *Scribner's* will suggest a solution for the problem of rapid transit as it now confronts the cities of New York, Chicago, and Boston. The New York plan, which he favors, involves a new street with an open-air viaduct on one side of it, abutting on great warehouses, the lower stories of which enter directly into the tunnel for freight trains beneath the viaduct.

— Messrs. Macmillan & Co. are about to issue, under the title of "Calmire" (a name of French origin, pronounced Calmēre), an exposition, through the medium of a story, of that scientific explanation of the basis of morals, for which many are seeking out-

CALENDAR OF SOCIETIES.

Society of Natural History, Boston.

May 18.—J. S. Kingsley, Notes on the Anatomy of Amphiuma; W. O. Crosby, On Some Evidences of Tertiary Deposits in the Boston Basin.

Biological Society, Washington.

May 14.—W. H. Seaman, The Photogenic Organs of Fireflies; C. Hart Merriam, A New Prairie Dog from Mexico; Charles Hallock, Where Salt-Water Fishes Hide: Results of Deep-Water Seining; Theo. Holm, Additions to the Flora of Washington (with exhibition of specimens); Frederick V. Coville, The Use of Certain Terms in Geographic Distribution.

Publications Received at Editor's Office.

BERNARD, HENRY MEYNERS. The Apodidae. New York, Macmillan & Co. 12°. 336 p. $2.

BUTLER, AMOS W. The Birds of Indiana. Brookville, Ind., Wm. B. Burford, printer. 8°, paper. 135 p.

NAEGELI, CARL AND SCHWENDENER, S. The Microscope in Theory and Practice. Trans. from the German. 2d ed. New York, Macmillan & Co. 8°. 394 p., ill. $2.60.

SMITHSONIAN INSTITUTION. Report of the National Museum for the year ending June 30, 1891. Washington, Government. 8°. 964 p.

U. S. BOARD ON GEOGRAPHIC NAMES. First Report. 1890-1891. Washington, Government. 8°. 56 p.

WEED, ALONZO R. Business Law. Revised ed. Boston, D. C. Heath & Co. 8°. 172 p. $1.10.

side of the historic creeds. It is entirely distinct in theory and mode of treatment from the widely-read novels touching on the religious question, and will take a place among the books most thoughtfully discussed by that increasing class of readers, which finds in the insistent problems of religion and the proletariat the most absorbing interests of the day.

— P. Blakiston, Son, & Co., Philadelphia, announce "Materia Medica, Pharmacy, Pharmacology, and Therapeutics," by Wm. Hale White, M.D., Physician to, and Lecturer on Materia Medica at Guy's Hospital; Examiner in Materia Medica Royal College of Physicians and Royal College of Surgeons, etc. This is an American copyright edition, edited by Reynold W. Wilcox, M.A., M.D., Professor of Clinical Medicine at the New York Post-Graduate Medical School and Hospital, Assistant Visiting Physician Bellevue Hospital, etc.

— The ninth volume of the new edition of "Chambers's Encyclopædia" is in a forward state, and will be published by the J. B. Lippincott Company in June. Another volume will complete this excellent work of reference The following are some of the principal articles and authors in the new volume: "Rousseau," Rev. H. G. Graham; "Runes," Canon Isaac Taylor; "Russia," "St. Petersburg," "Siberia," Prince Krapotkine; "Salmon," Archibald Young; "Salvation Army," Bramwell Booth; "Samoa," C. P. Lucas; "George Sand," Mr. G. Saintsbury; "Scandinavian Mythology," Professor Rasmus Andersen; "Schopenhauer," Professor W. Caldwell; "Schleiermacher," Dr. Otto Pfleiderer; "Spectrum," Professor Knott; "Scotland," history, Professor Grub; "Scottish Language," Dr. J. A. H. Murray; "Scottish Literature," Hume Brown; "Sir Walter Scott," Andrew Lang; "Seal," "Sole," J. T. Cunningham; "Secularism," Mr. G. J. Holyoake; "Shakespeare" and "Shelley," Professor Dowden; "Sheep," James MacDonald; Generals "Sheridan" and "Sherman," General Grant Wilson; "Shipbuilding," David Pollock; "Shorthand," Isaac Pitman; "Siam," J. S. Black; "Slang," C. G Leland; "Socialism," T. Kirkup; "Herbert Spencer," Professor Sorby; "Sphinx," Stanley Lane-Poole; "H. M. Stanley," J. S. Keltie; "Dean Stanley," Professor Story; "State Religion," Canon Curteis; "Steam" and "Steam-Engine," Professor A. B. W. Kennedy; "Sterne," Traill; "Strawberry," Blackmore.

QUERY.

Can any reader of *Science* cite a case of lightning stroke in which the dissipation of a small conductor (one-sixteenth of an inch in diameter, say,) has failed to protect between two horizontal planes passing through its upper and lower ends respectively? Plenty of cases have been found which show that when the conductor is dissipated the building is not injured to the extent explained (for many of these see volumes of Philosophical Transactions at the time when lightning was attracting the attention of the Royal Society), but not an exception is yet known, although this query has been published far and wide among electricians.

First inserted June 19. No response to date.

TO THE READERS OF SCIENCE.

PUBLISHER'S ANNOUNCEMENT.

OUR PLANS.

WITHIN the past six months the use of *Science* by scientific men and women as a medium for prompt publication and weekly discussion, has increased very materially, so that the pages are now well filled each week with original matter. As the number of those promising contributions is increasing at the rate of three or four each day, it cannot be long before *Science* at its present size will be too small for the amount of matter offered. We have under consideration therefore an enlargement of the paper by one-half, but must first learn the temper of our constituency as to an advance in price to $5.00, which was the subscription price from the start for four years, up to June 30, 1887. Further, to carry out the proposed enlargement, we shall need five hundred additional subscribers. If you are not already a subscriber, are you willing to aid in making *Science* more worthy of American scientific work by becoming one?

It goes without saying, that the demand for scientific literature is limited, when compared with that for literature which is more to the public taste, so that the receipts of most of the Scientific Journals, in this country, do not pay quite for their printing and paper, to say nothing of the other items of expense. We say this merely to emphasize the fact, that generous and prompt support must be accorded this move if it is to succeed.

Titles of Some Articles Published in *Science* since Jan. 1, 1892.

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Actinism.
Amenhotep, King, the tomb of.
Anthropology, Current Notes on.
Arsenical Poisoning from Domestic Fabrics.
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